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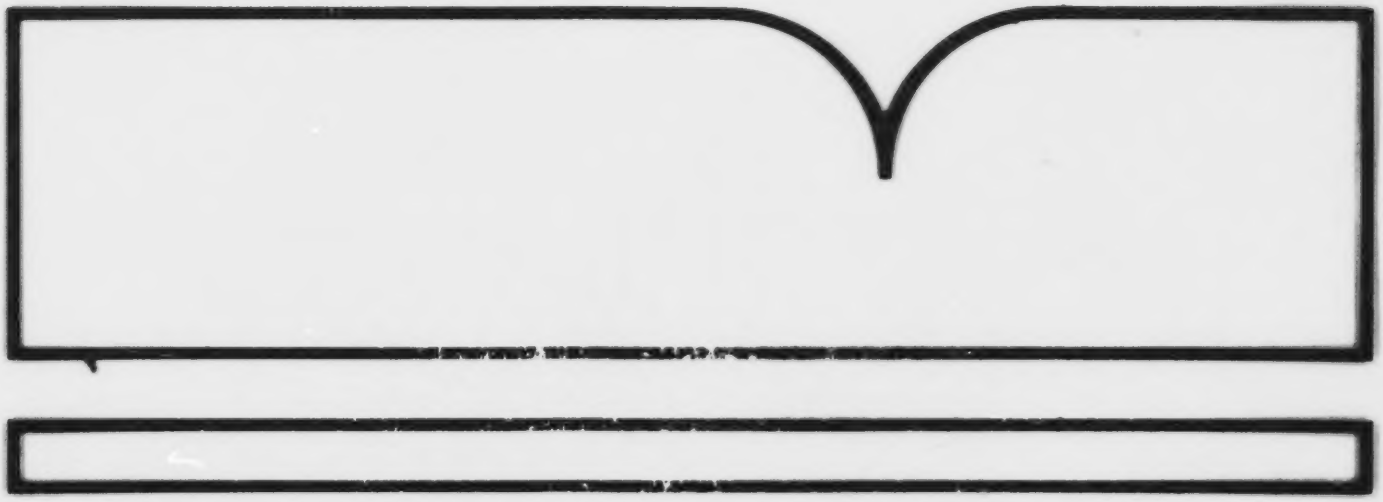
TSP Source Inventory Around Monitoring Sites in Selected Urban Areas, Portland

PEDCo-Environmental, Inc.
Kansas City, MO

Prepared for

Environmental Protection Agency
Research Triangle Park, NC

May 79



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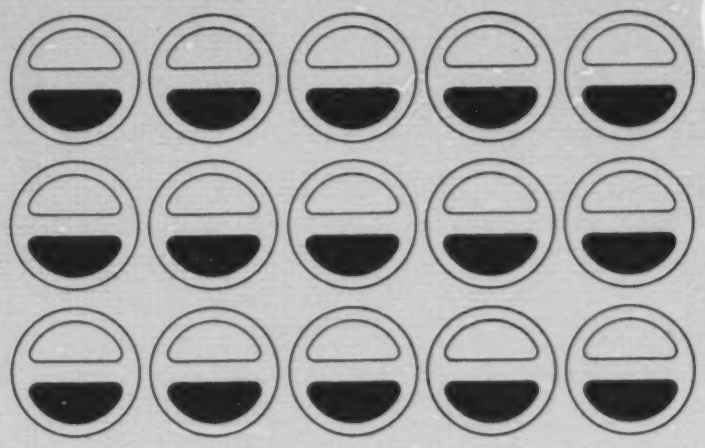

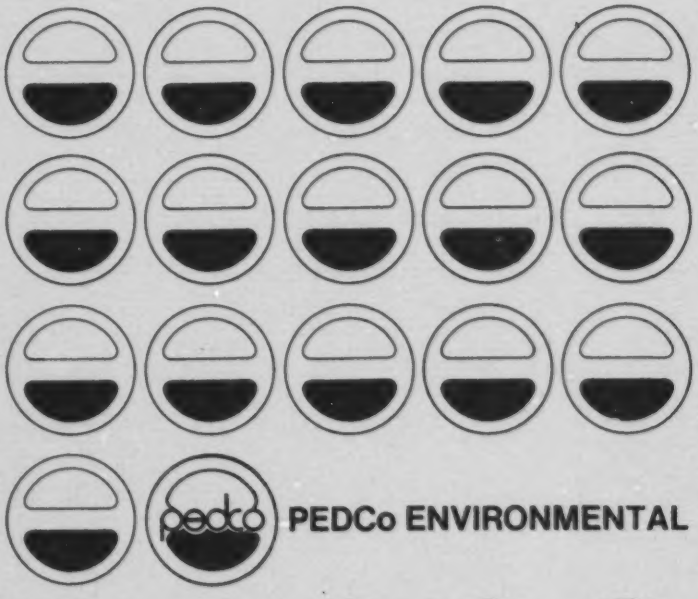

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EPA is developing an empirical model to relate ambient air quality to particulate emissions and land use in the surrounding area. This receptor-oriented model will be used for evaluating the effect of particulate control measures on concentrations at individual sites in a sampling network or for predicting air quality at a location where there is no sampler.

PEDCo Environmental is collecting most of this detailed data base used in the study and providing it to the EPA in the form of a series of reports, one for each of the five cities in which sites are to be surveyed: Kansas City, Portland, St. Louis, Birmingham, Philadelphia. Each of PEDCo's reports follow the same format, and the reports are confined almost entirely to data presentation.

The present report summarizes information for sites in the Portland area. The 10 high volume sampling sites inventories in the Portland area have a wide distribution of exposures ranging from industrial to background.

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TSP SOURCE INVENTORY AROUND MONITORING SITES IN SELECTED URBAN AREAS, PORTLAND

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1. INTRODUCTION

EPA is developing an empirical model to relate ambient air quality to particulate emissions and land use in the surrounding area. This receptor-oriented model will be used for evaluating the effect of particulate control measures on concentrations at individual sites in a sampling network or for predicting air quality at a location where there is no sampler.

Several studies have indicated that there is a statistically significant relationship between particulate concentrations measured at a high volume sampler and the emission density within a limited radius surrounding that site.[1,2,3,4,5] It is EPA's intention to improve the correlation observed for this basic source/receptor relationship by accounting for some or all of the following factors in the empirical model:

- distance to sources
- direction of sources
- differential impact of point and area source emissions
- sampler and source heights
- surrounding land use

By using weighting factors for different emissions in the area around the sampler, the model will build on the basic relationship and attempt to increase its accuracy.

The model will utilize data obtained from a technique referred to as a microinventory. The original microinventory

procedure, as outlined in a 1974 report,[1] consisted of an inventory of particulate sources within a 1.5 mile radius of a high volume sampler and the calculation of an average emission density (in ton/mi^2/yr) for the entire area. Subsequent reports have reduced the area to a one mile radius but left the other procedures essentially the same.[2,3] Most of the improvements in the technique in these reports have occurred as a result of fugitive dust emission factor development.

The next refinement of the inventory technique was based on an observed relationship between particulate concentrations and average daily traffic (ADT) on nearby streets.[5] Available traffic and TSP data for two cities indicated that ambient concentrations were directly related to ADT on the nearest street and inversely related to the slant distance (hypoteneuse of height and horizontal distance) from the sampler to that street. This relationship has been incorporated into the microinventory by giving special consideration to streets and other localized sources (within 200 ft of the sampler) during the field survey.

The concept of decreasing impact with distance has been expanded in recent particulate analyses to include classification of point and area sources into different ranges of distance from the sampler.[6,7] The sources were also classified by general direction from the sampler. Emissions from all area sources within 1/4 mile of the monitor were tabulated. Separate tabulations were made for sources within a 1/4 to 1/2 mile radius and a 1/2 to 1 mile radius, with each of these two radii being divided into quadrants. Thus, a total of nine sectors within the 1 mile radius were considered separately in the area source emission inventory.

In these same partiuclate analyses, point source emissions within a five mile radius were tabulated with respect to distance and direction from the monitor. The larger

radius was specified for point source emissions because of their greater dispersion potential than lower level emissions from area sources. It is relatively simple to calculate or scale from a map the distance from each point source to the monitor. Likewise, the compass direction from the monitor to the source can be easily determined.

An additional refinement of microinventory procedures has recently been proposed, but not yet fully evaluated. Land use in the area surrounding the sampler is thought to be related to the concentration measured at the sampler. A recent study reported the predominant land use in each of the nine sectors in the area source inventory area.[7] A land use determination was also made for the area from 1 to 3 miles from the sampler and the 1/4 mile radius sector was further divided into four quadrants for land use classification.

All of the refinements described above have been incorporated in the microinventories for developing the empirical model. This will permit variables such as distance, direction, point vs. area source, height and land use to be included in the resulting model if they are shown to improve its predictive capabilities. It has been estimated that this detailed emission data and land use information is needed for approximately 100 sites in order to adequately consider all these variables.

PEDCo Environmental is collecting most of this detailed data base and providing it to EPA in the form of a series of reports, one for each of the five cities in which sites are to be surveyed:

Kansas City	- 32 sites
Portland	- 10 sites
St Louis	- 11 sites
Birmingham	- 14 sites
Philadelphia	- 10 sites

Another contractor, GCA Corporation, is providing information for 12 sites in the Boston area. In addition, Rockwell International is providing corresponding data for 12 sites in their RAMS sampling network in St. Louis. Altogether, this will provide EPA with data from 101 sites.

Each of PEDCo's reports follow the same format as this one. The reports are confined almost entirely to data presentation; data analysis and model development will be performed by EPA. All of the data in this report are presented in a format appropriate for EPA's use in their analysis.

The present report summarizes information for sites in the Portland area. The 10 high volume sampling sites inventoried in the Portland area have a wide distribution of exposures ranging from industrial to background. The locations of the sites are shown in Figure 1-1. The data collected for the 10 sites are presented in Chapter 3. The methodology for performing the microinventories in Portland is presented in Chapter 2.

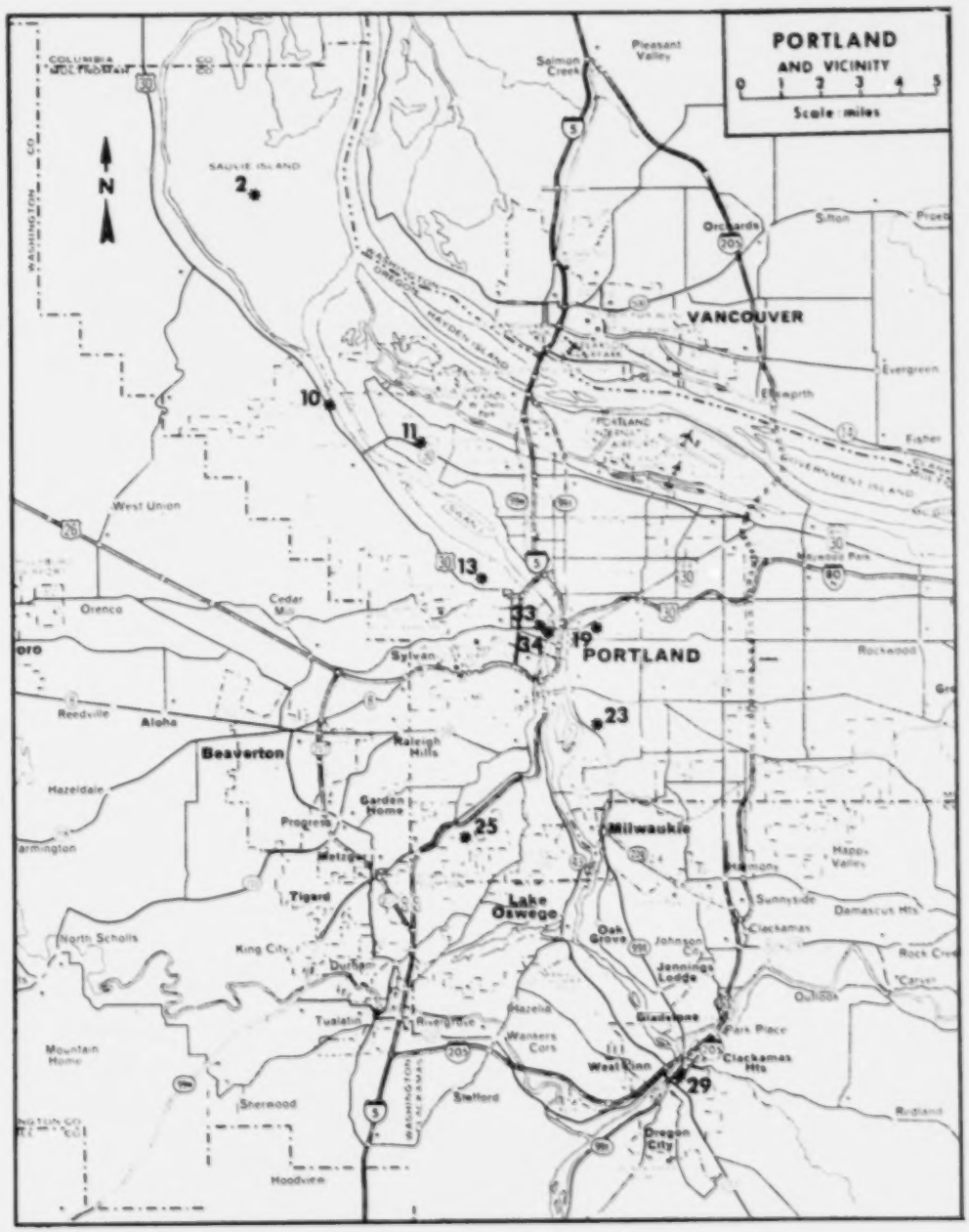


Figure 1-1. Locations of high volume samplers in the Portland Interstate AQCR.

LEGEND

Site no.	Site location
2.	Sauvie Island, Multnomah County
10.	11212 Northwest St. Helens Road, Portland, Oregon
11.	6941 North Central, Portland, Oregon
13.	3200 Northwest Yeon, Portland, Oregon
19.	1845 Northeast Couch, Portland, Oregon
23.	1830 Southeast Schiller, Portland, Oregon
25.	10625 Southwest 35th Street, Portland, Oregon
29.	Eighth and Main, Oregon City, Oregon
33.	718 West Burnside, Portland, Oregon
34.	55 Southwest Ash, Portland, Oregon

2. METHODOLOGY

MICROINVENTORY PROCEDURES

The microinventory technique described herein was developed over the past four years as part of particulate analyses in several regional areas. The procedures followed are not necessarily technically superior to alternative methods that might be used. However, they have evolved as a result of this past experience and are recommended for succeeding inventories, primarily to maintain consistency in data collection and to minimize the time required in the field.

The survey procedure employed in Portland was to ground survey, via automobile, the sampler stations and all probable sources of emissions within a one mile radius of each sampling site. This method enabled the survey team to make the best observation of overall site exposure and to identify the sources with primary impact on the samplers. The one mile radius around each sampler was specified because that is approximately the range to which theoretical treatments (dispersion modeling) show that low level sources will have a significant impact.

Sources of fugitive dust and conventional point and area sources were located on maps during the ground survey and labeled with pertinent data, such as size and boundaries, observed activity and operational characteristics, and estimated emission rates. Two observers independently estimated and agreed upon parameters observed at each site to increase accuracy and completeness.

Presurvey and Preparatory Work

Prior to undertaking the field surveys, a presurvey was performed. This presurvey consisted of a two day visit to Portland to gather the materials needed to perform the microinventories and to tour the sites to be inventoried. Point source, area source, air quality, and land use data were obtained from the local air pollution control agency. Traffic volume maps were obtained from the Columbia Regional Association of Governments, the regional planning agency.

Three other types of maps were also utilized during the Portland microinventories. USGS 7-1/2 minute quadrangle maps were used to locate sampler sites and point sources by UTM coordinates. They were also a convenient size and scale (1" = 2000') for covering the impact area--one mile radius for area sources and a five mile radius for point sources. Aerial photo maps (scale 1" = 200') were practical for marking area source locations and for estimating sizes of land areas. A city street map was used for planning the survey route and in navigating the route.

During the presurvey, each sampling site to be inventoried was visited. Photographs were taken of the sampler location. Monitor height and placement were recorded on an auxiliary data sheet and the sampler was located on the city street map. If any physical interference was observed that could bias the air quality readings, that information was also noted. The site code, street address, and distances of the nearest intersecting streets or localized sources were determined and recorded.

Following this presurvey, the preparatory work needed to perform the field surveys was completed. A one mile radius was drawn on the USGS map for each site, and the major streets were identified thereon. Copies of each of these maps were made for field use. A separate sketch of the 1/4 mile radius area was drawn to scale (1" = 400') to

provide even greater detail for the area close to the sampler. An alternative to the 1/4 mile radius sketch would have been to mark information directly on the aerial photo for each site.

Field Work

The actual inventory procedure followed was to begin at the sampler site and survey the 1/4 mile radius area first. The field team then observed each street within the 1/4 mile radius and noted the location of all the pertinent sources on the sketch. Closer inspections of the sources were made as necessary. All important parameters were independently estimated and then agreed upon by the two observers. For area sources, the type, dimensions, and activity rate were recorded. For point sources, the company name, source types, and estimated stack heights were noted. This information was usually recorded on an auxiliary data sheet.

The general condition of paved streets within the area was described on the 1/4 mile sketch by indicating whether streets were curbed or uncurbed. Surface conditions and dirt loadings were described as clean or dirty. Finally, the predominant land uses for the four quadrants were marked. The land use descriptors used are described in detail in a following section.

The above steps were repeated with little modification for the rest of the one mile radius survey area. In many cases, it was possible to inventory this area by driving across alternate streets, in a cross hatch pattern, covering each quadrant completely. In this way, all intersections and sources were observed from a maximum one block distance. Locations of point and area sources were shown on copies of the USGS map or, where available, on aerial photo maps; descriptions of the sources were recorded on the data sheets. Land use was determined both from the ground survey and from information obtained later from land use data.

Topography - The topography of each survey area was briefly characterized. Since the purpose was to account for any increase in concentrations that might occur as a result of pollutant trapping or decrease due to an elevated sampler, the topography description was primarily concerned with sampler placement rather than the surrounding land area. In order to keep this element of the model as simple as possible, only four descriptors were used:

- Elevated receptor
- Valley receptor
- Street canyon receptor
- No special terrain

Measuring Distances of Sources - For purposes of determining the distance from a source to the sampler, the following rules were observed:

Within 200 ft of the monitor	- determine distance to $\pm$5 percent during initial visit to the site
From 200 ft to 1/4 mile	- scale off the aerial photo map
From 1/4 to 1 mile	- scale off either the aerial photo map or the USGS map

Distances to sources within 200 ft of the monitor were recorded during the presurvey. Distances beyond 200 ft were scaled from a map and recorded on the data sheet at a later date following completion of the field work.

Defining Sources - So that all inventories were done with the same degree of detail, it was necessary to establish exactly what sources were to be included. Generally, all

fireplace and furnace stacks from residential, commercial, or institutional buildings were accounted for under the fuel combustion area source category and were not inventoried. If a stack emission appeared to involve an industrial process not included in the point source listing, the source was noted if the facility appeared to be operating at the time of the survey.

Defining what constitutes a fugitive dust source was somewhat more difficult; however, sources of fugitive dust would include at least the following activities:

- excavating
- grading
- detonation of explosives
- earth moving
- construction
- demolition
- site preparation
- sand blasting
- mining
- quarrying
- processing of sand, gravel, and rock
- crushing
- screening
- drying
- handling and transporting of materials
- barren storage areas or storage piles
- vehicle movement (reentrainment)
- unpaved roads
- unpaved parking lots
- agricultural tilling
- wind erosion of exposed surfaces
- feed lots
- campgrounds
- fairgrounds
- playgrounds
- athletic fields

Unpaved driveways or unpaved road shoulders were not included unless they were common to all the blocks in a particular segment. However, the presence of these sources often resulted in increased street dirt loadings, and those streets were noted to be dirty.

A significant factor in determining which temporary sources to consider is the time period for which the source is expected to be active. For example, a construction site should be included as a fugitive dust source only if the air quality data are for the period of time the site is active.

A checklist for the procedures discussed above is presented in Table 2-1. This list should facilitate both the planning and the execution of the field surveys so that consistent data collection is achieved for succeeding microinventories.

LAND USE DETERMINATION

Area sources were identified within one mile of each sampling site, but an attempt was made to determine the major land uses within a three mile radius of the site. The rationale for this extension was that the relative impact of land use has not yet been established, so it is reasonable to collect slightly more data than may ultimately be necessary for analysis. The 16 segments within the three mile radius are shown in Figure 2-1. The predominant land use in each segment was categorized based on descriptors listed in Table 2-2. Again, since the input requirements for land use data in the empirical model are uncertain, these descriptors may be modified at a later date.

An initial land use description was obtained for each segment from data provided by the local agency. This description was further refined from observations made during the ground survey and from USGS maps. In a few cases, the most appropriate land use designation may be the use which affects air quality most rather than the majority land use. This designation may change as the land area located in the sectors increases. For example, one or more point sources located in sector 1a would be sufficient to classify this sector as general industry. However, in sector 13 more than nine point sources (>25 tons) and a large percentage of industrial land area (<30 percent) would be required for a general industry designation. A similar rational was utilized to choose the most appropriate land use for sectors in which land use was not clearly defined. In summary, the land use

Table 2-1. CHECKLIST OF STEPS IN MICROINVENTORY

Presurvey and preparatory work

1. Identify sampling sites to be inventoried: record SAROAD code and street address
2. Determine distances to localized sources within 200 feet and sampler height (obtained during site tour)
3. Note possible interferences or biases (obtained during site tour)
4. Take photographs of site and surrounding area (obtained during site tour)
5. Obtain U.S. Geological Survey maps of the area (from either USGS or a local engineering supply store)
6. Obtain land use maps (from local Council of Governments)
7. Obtain traffic data (from local COG, or city or state transportation agency)
8. Obtain recent air quality data (local air pollution control agency)
9. Obtain gridded inventory of area source emissions (local agency)
10. Obtain point source inventory including annual particulate emissions and UTM coordinates (local agency)
11. Obtain aerial photographs (from local COG or city engineering department)
12. Prepare maps for field survey (USGS maps and 1/4 mile sketches)

Field work

1. Describe topography around sampler
2. Survey 1/4 mile area: locate all sources on 1/4 mile sketch, describe on data sheet
3. Note condition of streets
4. Survey remainder of one mile radius area: locate sources on copy of USGS map, describe on same data sheet as above
5. Determine predominant land use by sector

Calculations

1. Allocate area source emissions (from agency inventory) to one mile radius area and to subareas
2. Calculate emissions for discrete fugitive dust sources; assign to appropriate sectors
3. Calculate vehicle-related emissions by sector
4. Prepare table of point source data by increasing distance from site
5. Compare listing with point sources identified in field; add to list any sources missed
6. Add small point sources (less than 25 ton/yr) as an area source category
7. Make final decision on land use description for each sector

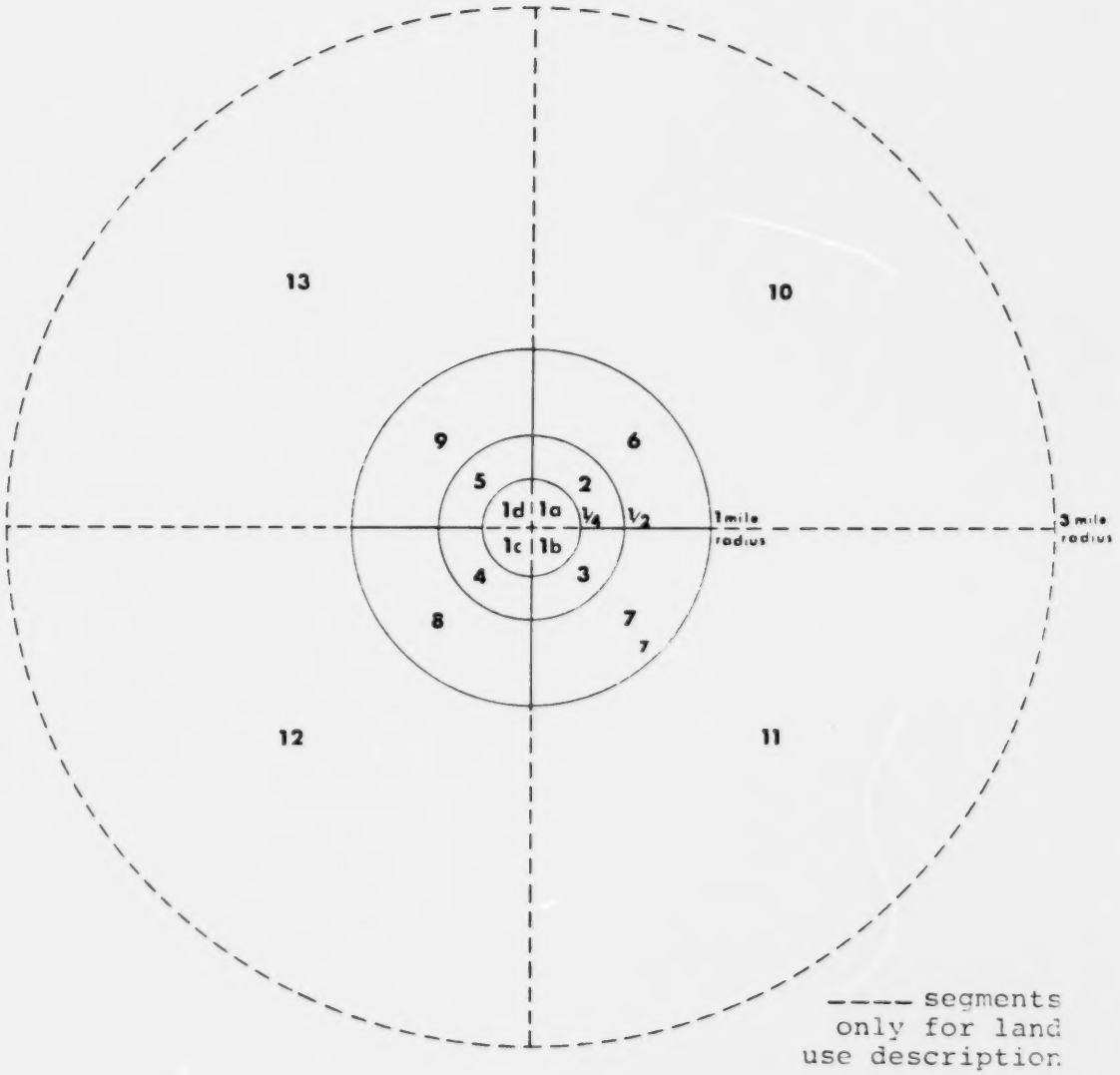


Figure 2-1. Land use and area source sectors used for the survey areas.

Table 2-2. LAND USE DESCRIPTORS

Descriptor	Characteristics
Undeveloped	No significant activity; includes parks, pasture land, lakes, rivers and forests
Agriculture	Land under cultivation at some time during the year
Light residential	Four or less dwelling units/acre
Dense residential	Greater than four dwelling units/acre, includes apartments
Suburban commercial	Retail businesses in strip development or shopping centers
Central commercial	Central business district
Light industry	Metal fabrication, warehousing, trucking, etc., includes few point sources
General industry	Controlled industrial processes includes majority of point sources
Heavy industry	Steel mills, foundries, coking, etc.
Airport	Municipal airport

descriptor chosen for each sector was based on available land use data, USGS maps, and field surveys.

COLLECTION OF POINT SOURCE DATA

During the ground survey, an attempt was made to locate every significant particulate point source. Annual particulate emissions from those industrial sources identified were estimated either from the point source listing or an engineering knowledge of the processes involved. Further, any source listed in the point source file and not identified in the survey was located using UTM coordinates and street addresses.

A table of point sources within five miles of the monitor was compiled for each of the sampler sites. Only those sources with estimated annual particulate emissions of 25 ton/yr or more were considered to be point sources. Smaller sources listed in the point source file were considered only if they were located within one mile of a sampler. The emissions from these sources were combined with either the industrial process or the industrial fuel combustion area source categories. The complete list of greater than 25 ton/yr point sources in the Portland area is included in Appendix A.

CALCULATION OF AREA SOURCE EMISSIONS

As discussed previously, an area within a one mile radius was inventoried for each of the 10 sites. This area was divided into nine sectors as shown in Figure 2-1. Based on data obtained from the survey, estimates were made of fugitive dust emissions in each sector. All identified fugitive dust sources within the survey area were recorded on the data sheet with estimates of size, location, and activity. Appropriate emission factors were then applied to each source to calculate estimated annual emissions. These

emission factors are discussed in Appendix B. The individual emission factors used for each source category in Portland are listed in Table 2-3.

Conventional area source emissions not accounted for in the survey were included in order to determine total area source particulate emissions by sector. The categories of conventional area sources considered included emissions from fuel combustion, incinerators, locomotives, vessels, and small point sources. Emissions from these sources were obtained from the gridded inventory of area source emissions for Portland.[8] The emissions were summarized for the Portland area by source category in two kilometer grids. The microinventory areas were superimposed on a map of the gridded inventory area; emissions were then apportioned to the microinventory areas from the grids on the basis of land area. These area source emissions were reapportioned to the nine sectors of the one mile radius area on the basis of land area: sector 1, 6.0 percent; sectors 2-5, 4.7 percent each; sectors 6-9, 18.8 percent each. It was not practical with the available data to determine exact emissions by sector. Although this appears to negate the effect of sectoring in Portland, the conventional area source emissions are generally much less than those from fugitive dust or vehicle-related sources.

Emissions for two other sources, vehicle exhaust and reentrained dust from streets, were calculated for each sector based on the vehicle miles traveled (VMT) in each sector. These VMT data were calculated from a Portland traffic volume map.[9] Annual traffic volumes were obtained by multiplying the daily VMT by 365.

Table 2-3. EMISSION FACTORS FOR MICROINVENTORIES

Source category	Emission factor	Units
Railroad yards	0.1	ton/acre/yr
Reentrained dust		
clean paved streets	2.6	gm/VMT
commercial streets	11.3	gm/VMT
exhaust	0.6	gm/VMT
Unpaved roads	2.3	lb/VMT
Cleared or exposed areas	0.06	ton/acre/yr
Construction	0.13	ton/acre/mo
Agriculture	0.04	ton/acre/yr
Aggregate storage	0.22	ton/acre/yr
Unpaved parking lots	1.1	lb/VMT
Unpaved storage areas	0.15	ton/acre/yr
Grain elevators	1.8	ton/silo/yr
Incinerators	7.0	lb/ton of refuse

3. SITE SUMMARIES

A six page summary was compiled for each of the 10 particulate sampler sites inventoried in the Portland AQMA. These site data summaries are presented in this chapter.

The first page of the summary is a complete description of the individual site including the SAROAD code, the street address, the location and height of the monitor, the land use within a three mile radius, the topography in the vicinity of the site, localized sources within 200 ft of the monitor, and air quality data for a four year period.

The sampler site locations and surrounding one mile radius survey areas are illustrated on the second page. The third page of each summary is a more detailed map showing sources within 1/4 mile of the sampler.

Two photographs illustrating the sampler, one viewed in the direction where the greatest potential for localized pollution influence existed, are presented on the fourth page of each summary.

A listing of all the point sources identified in the Portland AQMA is included in this report (Appendix A). The listing is limited to those sources emitting greater than 25 ton/yr. Each source is designated by number. The fifth page of the summaries lists any of these point sources located within a five mile radius of the sampler. Those sources within one mile are also located on the map of the survey area.

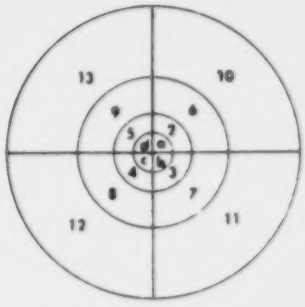
Any source emitting less than 25 ton/yr and within one mile of the sampler is included under the industrial process area source category or allocated to the appropriate area source combustion category.

The sixth page summarizes the area sources for a one mile radius about each sampler site.

DESCRIPTION OF SITE

SAROAD code - 38 1460 104

Location - Sauvie Island
Multnomah County



Monitor height - 12 ft, on roof of trailer

Land use, by sector -

1a agriculture	6 agriculture
1b agriculture	7 agriculture
1c undeveloped	8 undeveloped
1d undeveloped	9 agriculture
2 agriculture	10 undeveloped
3 agriculture	11 undeveloped
4 agriculture	12 undeveloped
5 agriculture	13 undeveloped

Topography-no special terrain

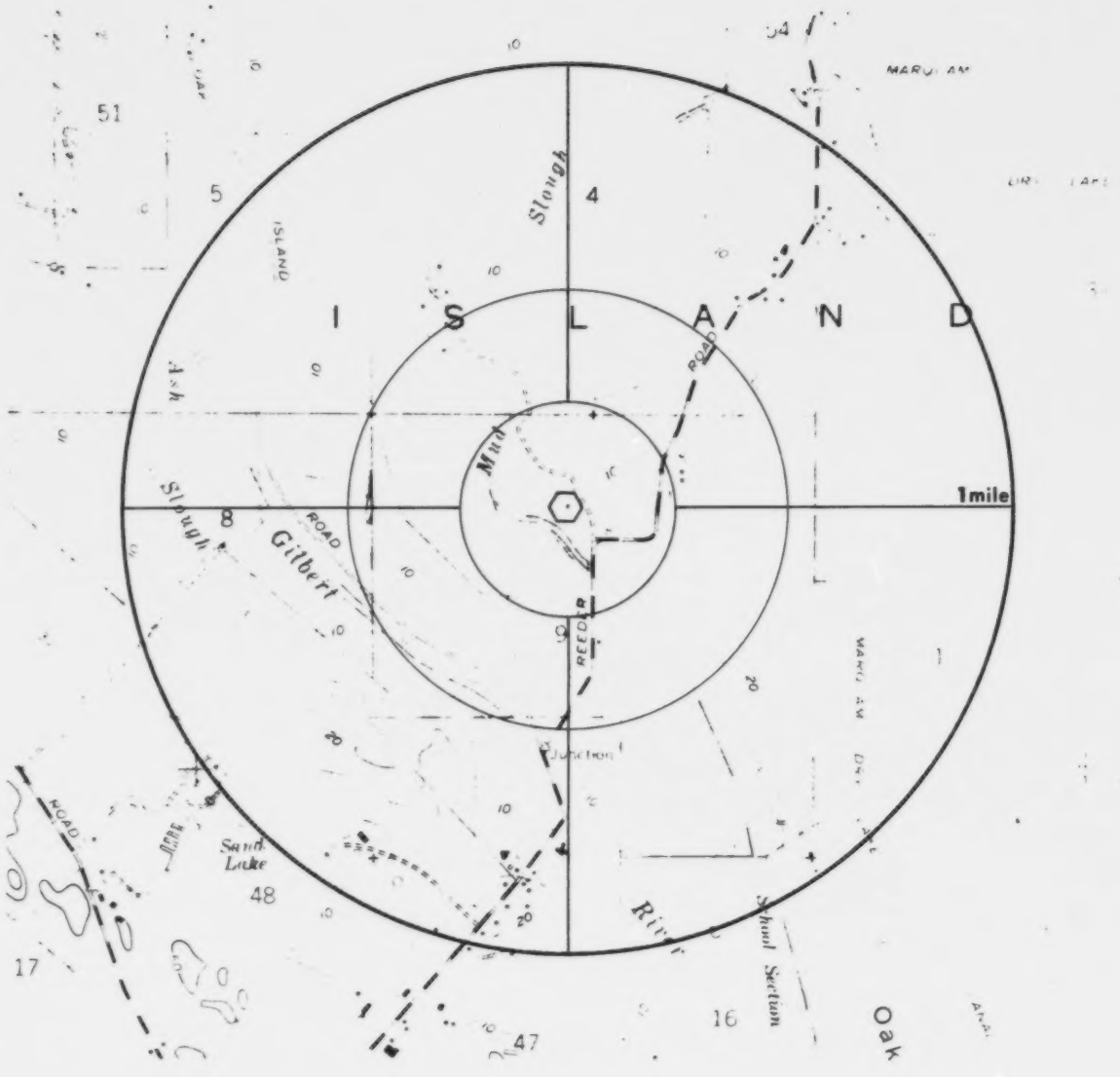
Localized sources, within 200 ft of monitor -

Source	Distance	Description
None		

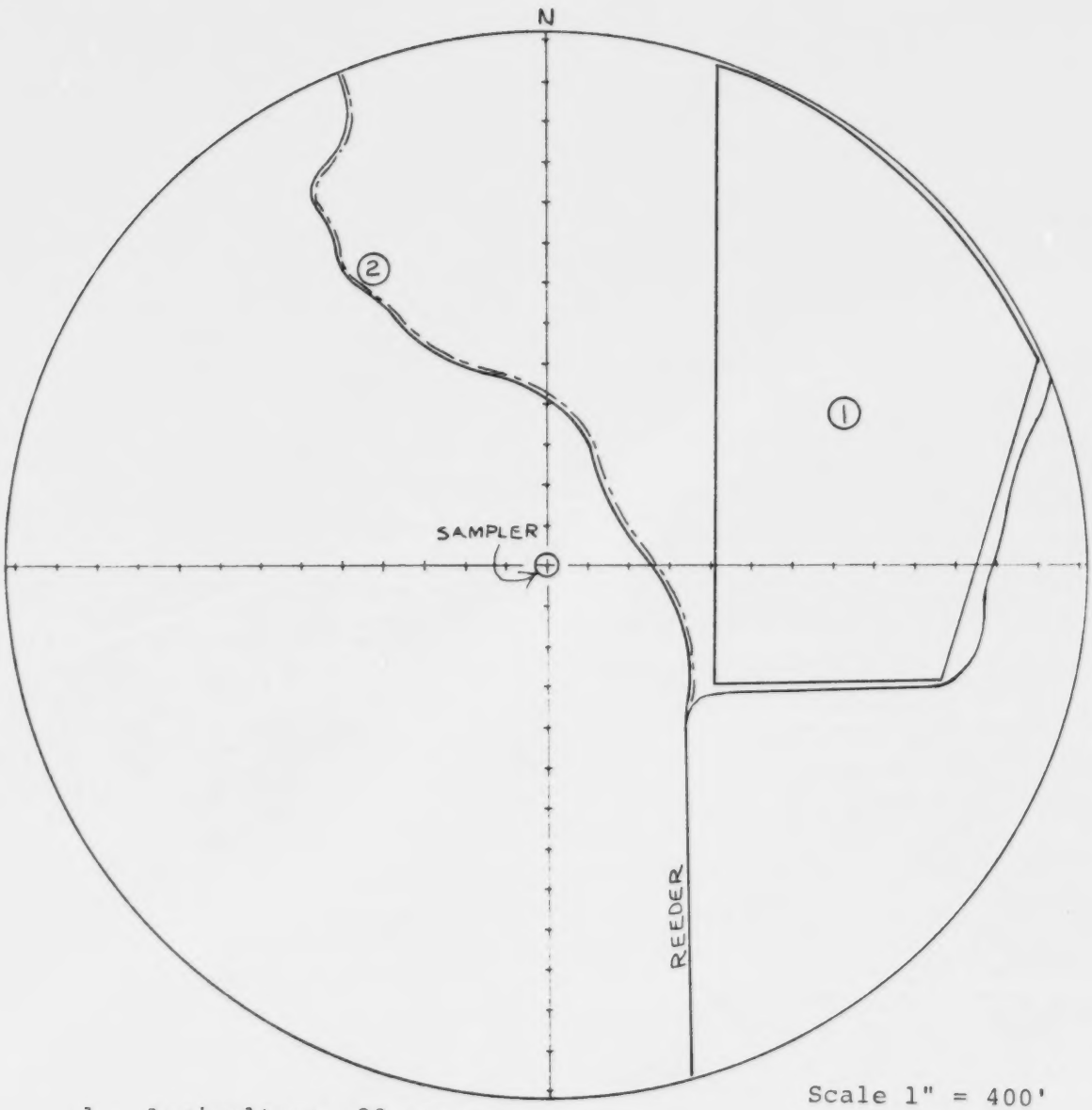
Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1977	30.0	52
1976	53.1	24[a]

[a] Four months data.



One mile radius around Sauvie Island site.



Scale 1" = 400'

1. Agriculture, 20 acres
2. Unpaved road, 2050 ft, 5 cars

One-quarter mile radius around Sauvie Island site.

Viewed to the north-northwest.

Viewed to the west.

Sampler at Sauvie Island.

POINT SOURCE SUMMARY

Site: Sauvie Island

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction,°
23	130	3.7	160
21	47	3.9	160
27	707	4.4	115

AREA SOURCE SUMMARY

Site: Sauvie Island

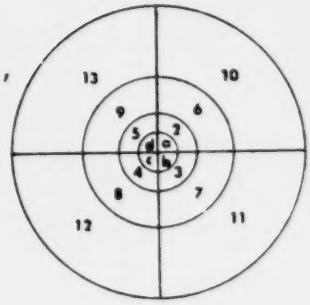
Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	neg										neg
Comm/Ind fuel	neg										neg
Incinerators											
Rail/Air											
Auto exhaust	58×10^3 VMT										neg
AREA SOURCE INDUS PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards											
Clean streets	58×10^3 VMT										neg
Comm streets											
Unpaved roads	1.4 mi		0.8			0.6				1.5	2.9
Cleared areas											
Construction	0.25 ac	0.1									0.1
Agriculture	820 ac	0.8	2.0	2.0	2.0	2.0	8.0	8.0		8.0	32.8
Storage areas											
Unpaved pkg lots											

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION				
IND PROCESSES				
FUGITIVE DUST	0.9	9.4	25.5	35.8
Total	0.9	9.4	25.5	35.8

DESCRIPTION OF SITE

SAROAD code - 38 1460 036

Location - 11212 Northwest St. Helens Road,
Portland, Oregon



Monitor height - 17 ft, on roof of
fire station

Land use, by sector -

1a light industry	6 general industry
1b light industry	7 light industry
1c undeveloped	8 undeveloped
1d light industry	9 undeveloped
2 undeveloped	10 light industry
3 light industry	11 light industry
4 undeveloped	12 undeveloped
5 light industry	13 undeveloped

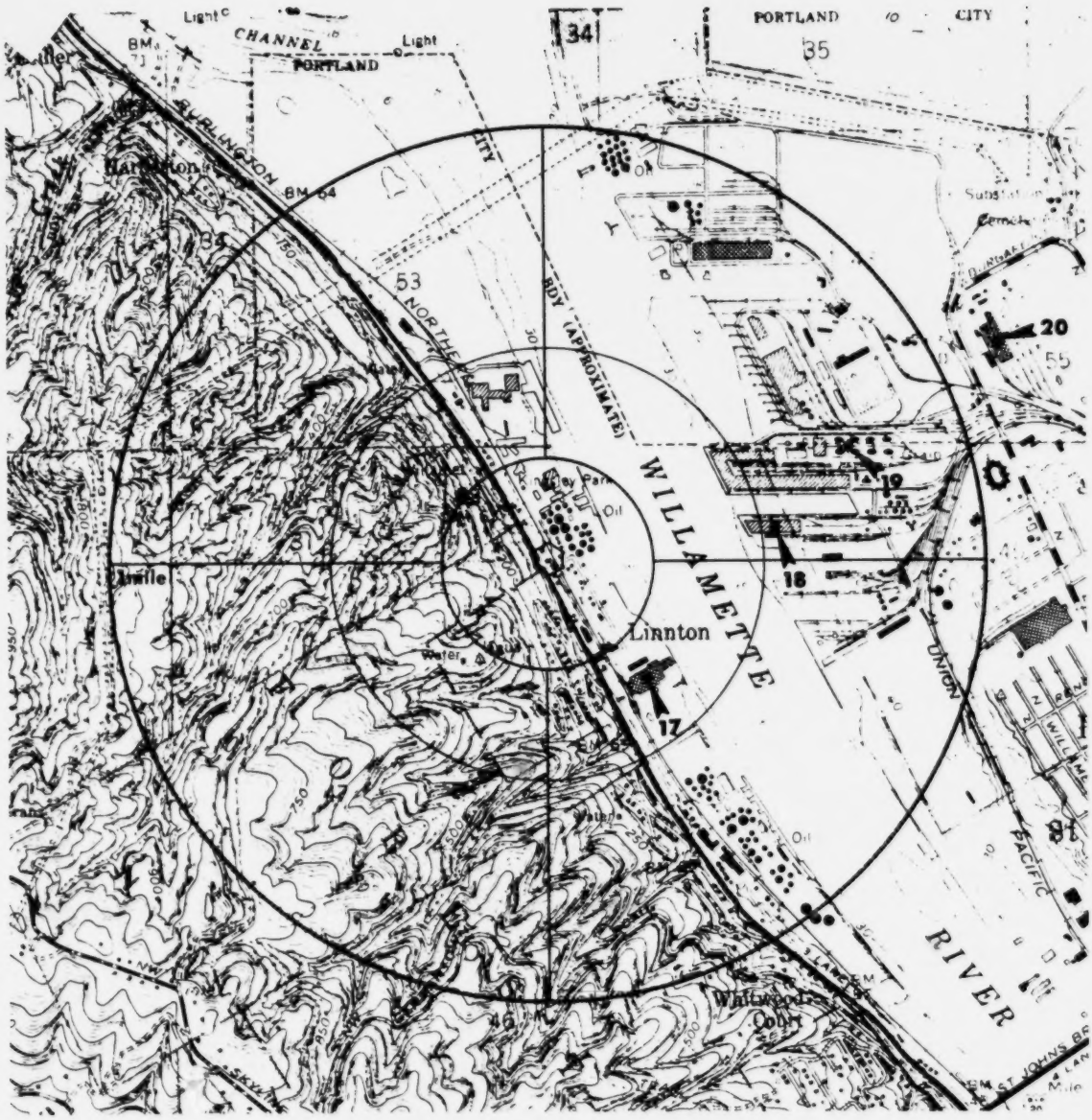
Topography-River Valley

Localized sources, within 200 ft of monitor -

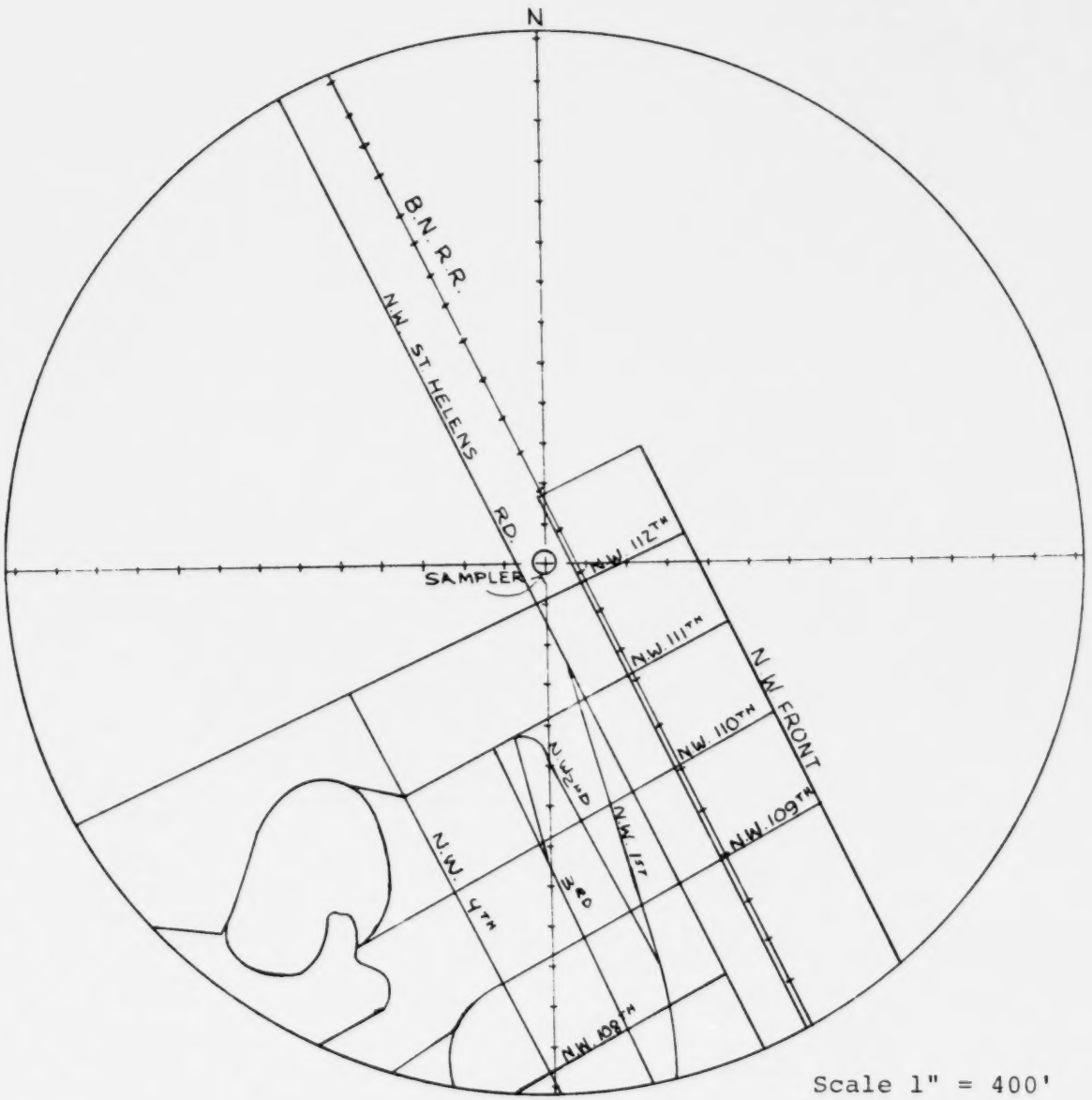
Source	Distance	Description
Northwest 112th Street	90 ft	200 ADT, clean, curbed
Northwest St. Helens Road	45 ft	14,600 ADT, clean, curbed
Northwest 113th Street	180 ft	200 ADT, clean, curbed

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	52	58
1975	41	59
1974	51	60
1973	57	75



One mile radius around 11212 Northwest St. Helens Road site.



Scale 1" = 400'

One-quarter mile radius around 11212 Northwest St. Helens Road site.

Viewed to the north.

Viewed to the south-southeast.

Sampler at 11212 Northwest St. Helens Road.

POINT SOURCE SUMMARY

Site: 11212 Northwest St. Helens Road

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction, °
17	52	.36	140
18	33	.51	80
19	656	.76	70
20	41	1.2	65
21	47	1.5	10
23	130	1.6	5
14	61	3.0	140
13	31	3.2	140
16	183	3.7	100
27	707	4.1	40
15	175	4.8	100
26	848	4.8	60

AREA SOURCE SUMMARY

Site: 11212 Northwest St. Helens Road

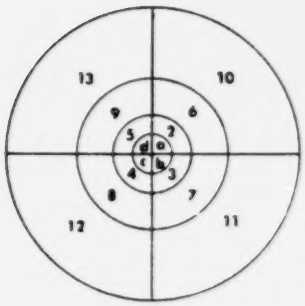
Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	neg										neg
Comm/Ind fuel							1.0	1.0			2.0
Incinerators											
Rail/Air/Ships		0.5	1.8	2.0		0.2	7.7	8.2		6.7	27.1
Auto exhaust	15.2×10^6 VMT	2.3		1.1		1.1	0.9	2.3		2.3	10.0
AREA SOURCE INDUS PROCESSES:											
Ind processes		1.0					25.0	8.8		10.0	44.8
FUGITIVE DUST:											
Railroad yards	31 ac	0.2		0.1		0.1	1.6	0.9		0.2	3.1
Clean streets	13.9×10^6 VMT	9.9		5.0		5.0		9.9		9.9	39.7
Comm streets	1.4×10^6 VMT						17.3				17.3
Unpaved roads											
Cleared areas											
Construction											
Agriculture											
Storage areas	24 ac						3.6				3.6
Unpaved pkg lots											

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	2.8	6.2	30.1	39.1
IND PROCESSES	1.0		43.8	44.8
FUGITIVE DUST	10.1	10.2	43.4	63.7
Total	13.9	16.4	117.3	147.6

DESCRIPTION OF SITE

SAROAD code - 38 1460 003

Location - 6941 North Central,
Portland, Oregon



Monitor height - 33ft, on roof of
Roosevelt High School

Land use, by sector -

1a dense residential
1b dense residential
1c dense residential
1d dense residential

2 dense residential
3 dense residential
4 dense residential
5 dense residential

6 light industry
7 dense residential
8 light industry
9 dense residential

10 general industry
11 light industry
12 light industry
13 general industry

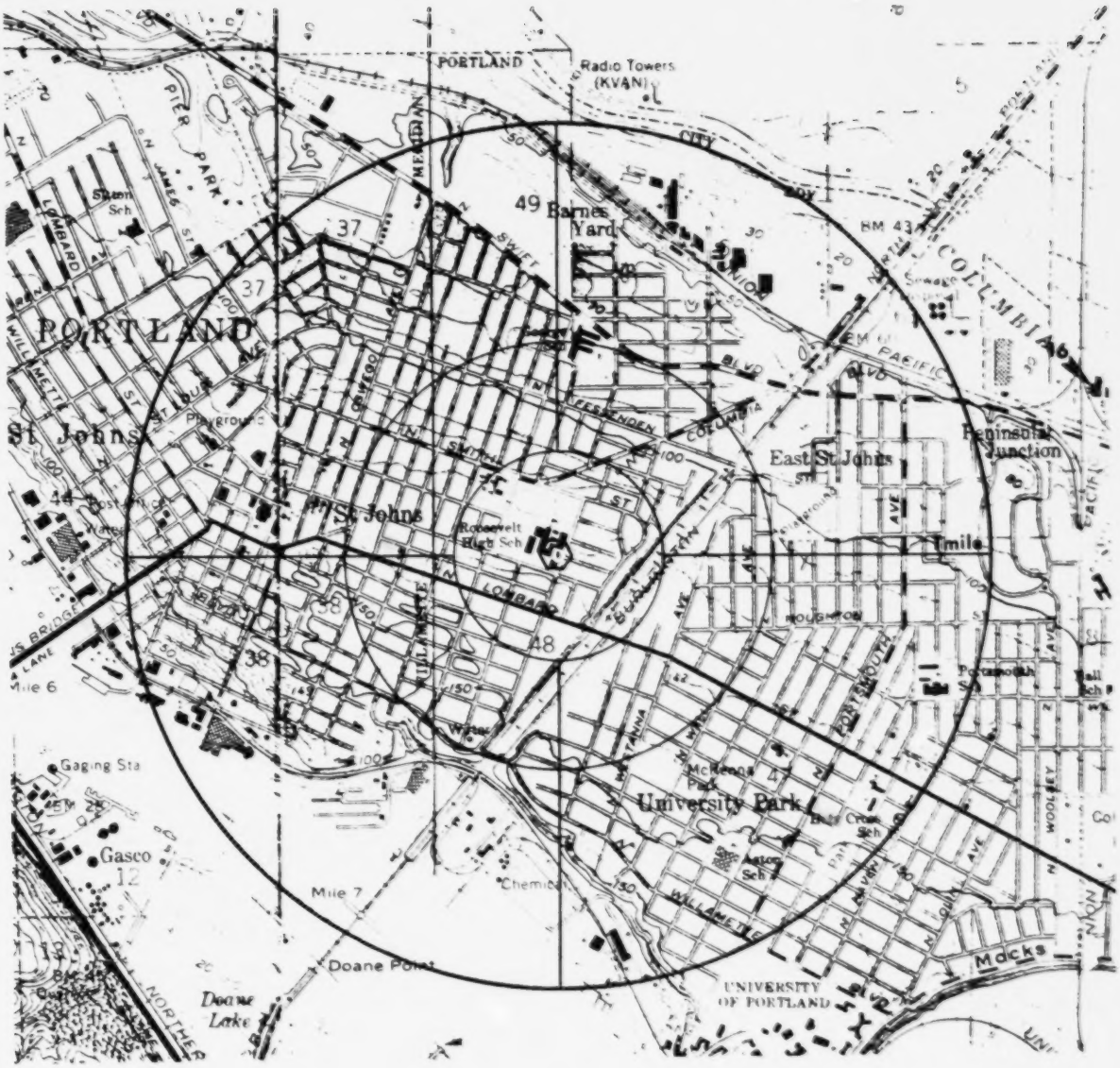
Topography-no special terrain

Localized sources, within 200 ft of monitor -

Source	Distance	Description
Sky Street	85 ft	200 ADT, clean, curbed
North Ida Street	55 ft	1400 ADT, clean, curbed

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	46	61
1975	37	54
1974	44	58
1973	44	72



One mile radius around 6941 North Central site.

Scale 1" = 400'

1. Unpaved road, 120 ft, 50 cars
2. Unpaved road, 420 ft, 50 cars
3. Railroad yard, 2.7 acres

One-quarter mile radius around 6941 North Central site.

Viewed to the southeast.

Viewed to the northwest.

Sampler at 6941 North Central.

POINT SOURCE SUMMARY

Site: 6941 North Central

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction,°
16	183	1.3	70
14	61	1.4	195
13	31	1.6	190
20	41	2.0	315
19	656	2.1	305
18	33	2.1	300
17	52	2.3	285
15	175	2.3	90
11	28	3.2	160
21	47	3.2	320
23	130	3.4	320
24	43	3.6	40
26	848	3.7	30
22	71	3.8	50
25	82	3.9	40
27	707	4.1	5
10	150	4.9	140

AREA SOURCE SUMMARY

Site: 6941 North Central

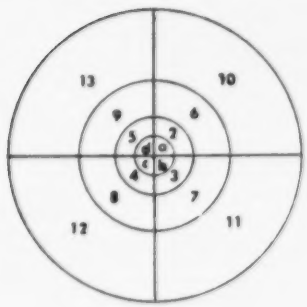
Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel		0.1	0.1	0.1	0.1	0.1	0.4	0.4	0.4	0.4	2.1
Comm/Ind fuel		0.1	0.1	0.1	0.1	0.1	0.4	0.4	0.4	0.4	2.1
Incinerators											
Rail/Air		0.2	0.2	0.2			0.4				1.0
Auto exhaust	32.2×10^6 VMT	2.2	1.3	1.0	0.9	0.8	3.9	4.5	1.1	5.6	21.3
AREA SOURCE INDUS PROCESSES:											
Ind processes							9.0	3.0	15.8	3.0	30.8
FUGITIVE DUST:											
Railroad yards	22 ac	0.3	0.3		0.1		1.0		0.5		2.2
Clean streets	31.7x106 VMT	9.4	5.8	4.4	4.0	3.4	16.0	19.5	4.3	24.2	91.0
Comm streets							3.6			1.8	5.4
Unpaved roads	8.9×10^3 VMT	4.2	0.8			2.8				4.6	12.4
Cleared areas	0.4×10^3 VMT										
Construction											
Agriculture											
Storage areas	42 ac						0.6	1.4	4.4		6.4
Unpaved pkg lots	7.8 ac						0.9			3.2	4.1

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	2.6	5.2	18.7	26.5
IND PROCESSES			30.8	30.8
FUGITIVE DUST	13.9	21.6	86.0	121.5
Total	16.5	26.8	135.5	178.8

DESCRIPTION OF SITE

SAROAD code - 38 1460 023

Location - 3200 Northwest Yeon,
Portland, Oregon



Monitor height - 33 ft, on roof of
building

Land use, by sector -

1a light industry	6 light industry
1b light industry	7 light industry
1c light industry	8 dense residential
1d light industry	9 light industry
2 light industry	10 dense residential
3 light industry	11 central commercial
4 light industry	12 light residential
5 light industry	13 light industry

Topography-no special terrain

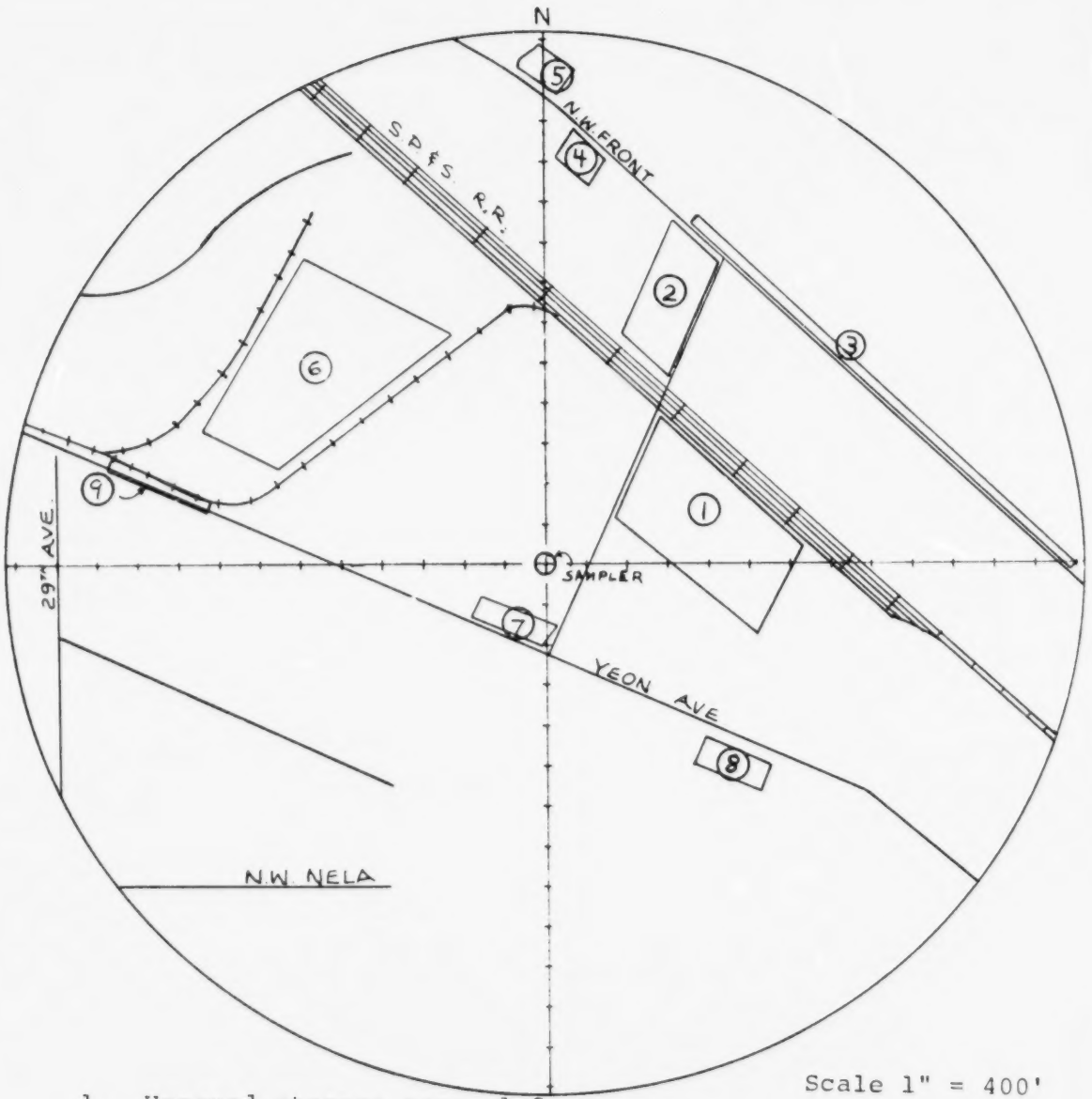
Localized sources, within 200 ft of monitor -

Source	Distance	Description
Northwest 26th Street	105 ft	2400 ADT, clean, curbed
Unpaved parking lot	150 ft	0.1 acre, 10 cars
Loading dock	25 ft	gasoline, diesel, exhaust
Yeon Street	200 ft	12,000 ADT, clean, curbed

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	63	68
1975	58	59
1974	65	54
1973	66	72

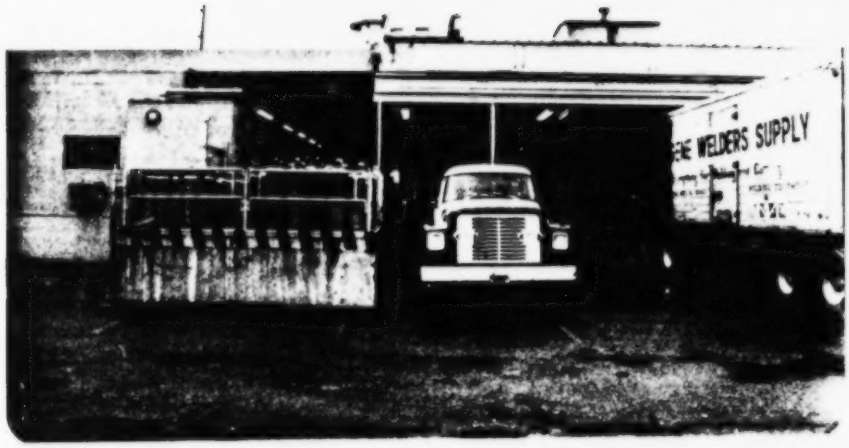
One mile radius around 3200 Northwest Yeon site.



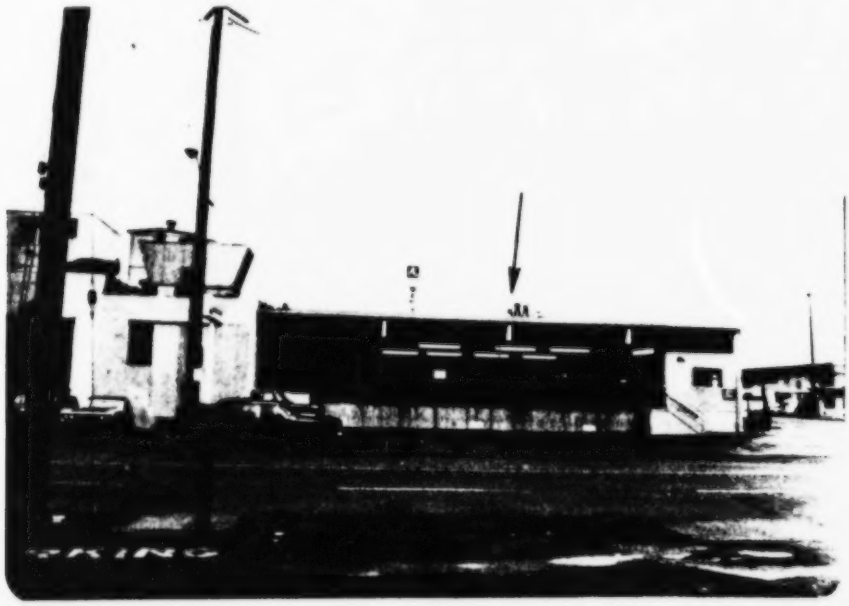
Scale 1" = 400'

1. Unpaved storage area, 1.8 acre
2. Unpaved storage area, 1.0 acre
3. Unpaved lot, .4 acre, 100 cars
4. Exposed area, 1.0 acre
5. Unpaved lot, 0.1 acre, 5 cars
6. Metal scrap storage area, 5.5 acres
7. Unpaved lot, 0.1 acre, 25 cars
8. Unpaved lot, 0.3 acre, 30 trucks
9. Unpaved lot, 0.2 acre, 20 cars

One-quarter mile radius around 3200 Northwest Yeon site.



Viewed to the south-southwest.



Viewed to the west-northwest.

Sampler at 3200 Northwest Yeon.

POINT SOURCE SUMMARY

Site: 3200 Northwest Yeon

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction, °
11	28	.27	290
10	150	1.8	120
8	142	2.2	120
13	31	2.3	305
14	61	2.5	310
15	175	3.0	15
16	183	3.4	355
9	86	3.6	110

AREA SOURCE SUMMARY

Site: 3200 Northwest Yeon

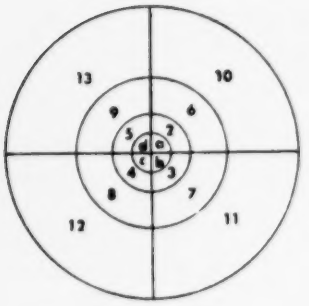
Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	neg										neg
Comm/Ind fuel		0.6	0.3	0.3		0.3		2.0		3.1	6.6
Incinerators											
Rail/Air/Ships		0.3	3.3			0.3	4.3	3.8		3.4	15.4
Auto exhaust	57.8×10^6 VMT	6.6		3.4	0.6	2.8	2.9	10.5	5.8	5.6	38.2
AREA SOURCE INDUS PROCESSES:											
Ir ˆ processes		8.6		7.0	4.0	3.0	2.0	57.0	2.0	7.9	91.5
FUGITIVE DUST:											
Railroad yards	154 ac	0.7		0.2		1.2	8.6	0.6	0.1	4.0	15.4
Clean streets	57.8×10^6 VMT	28.8		14.6	2.7	12.0	12.8	45.7	25.1	24.1	165.8
Comm streets											
Unpaved roads											
Cleared areas	3.9 ac			0.1						0.1	0.2
Construction											
Agriculture											
Storage areas	16.8 ac	1.2			0.3			0.6		0.4	2.5
Unpaved pkg lots	11.1 ac	0.8		0.1				8.2	0.3	0.2	9.6

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	7.5	11.3	41.4	60.2
IND PROCESSES	8.6	14.0	68.9	91.5
FUGITIVE DUST	31.5	31.2	130.8	193.5
Total	37.6	56.5	251.1	345.2

DESCRIPTION OF SITE

SAROAD code - 38 1460 012

Location - 1845 Northeast Couch,
Portland, Oregon



Monitor height - 18 ft, on roof of
one story building

Land use, by sector -

1a dense residential	6 dense residential
1b dense residential	7 dense residential
1c dense residential	8 light industry
1d light industry	9 central commercial
2 dense residential	10 dense residential
3 dense residential	11 dense residential
4 dense residential	12 light industry
5 dense residential	13 light industry

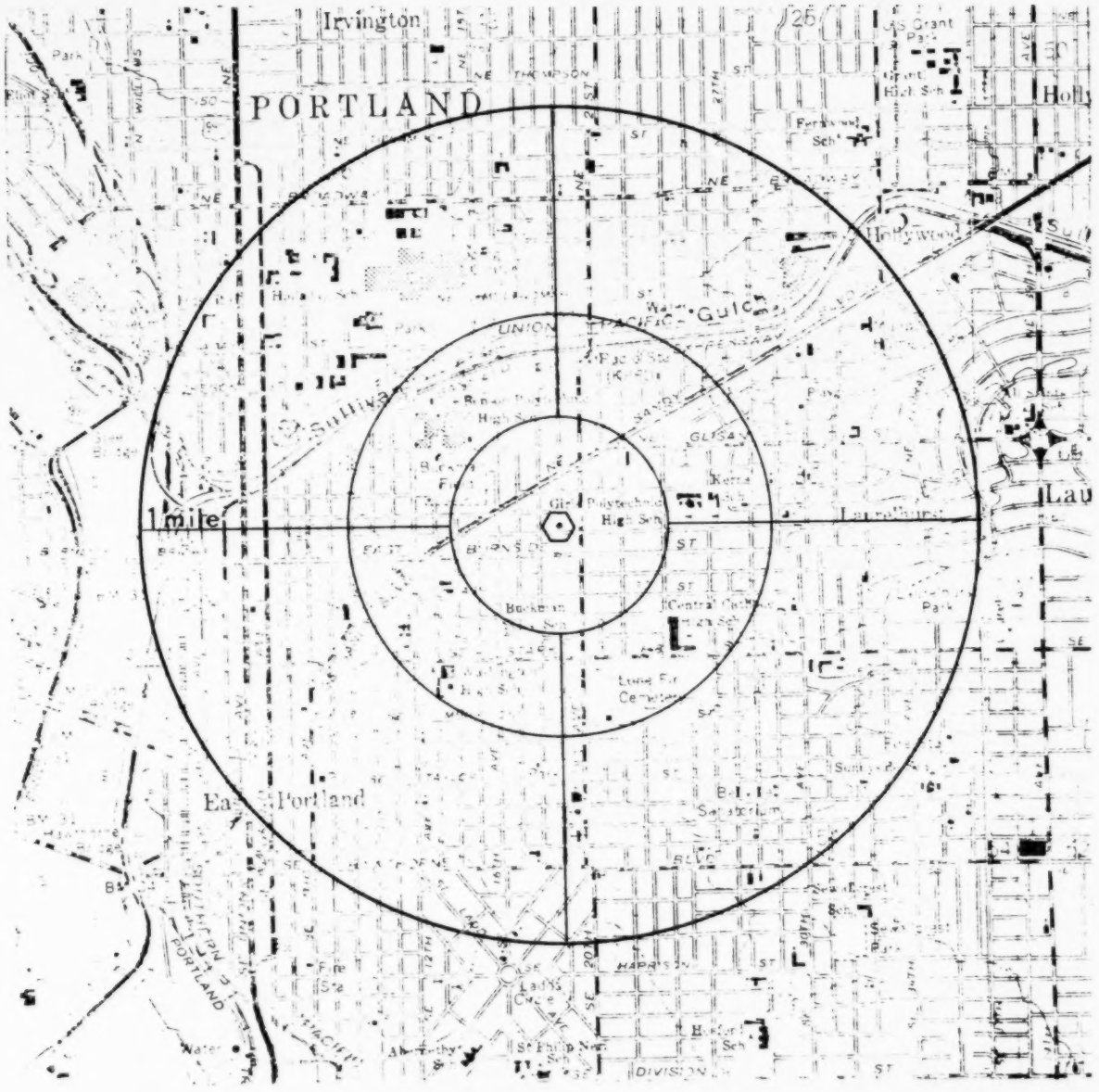
Topography-no special terrain

Localized sources, within 200 ft of monitor -

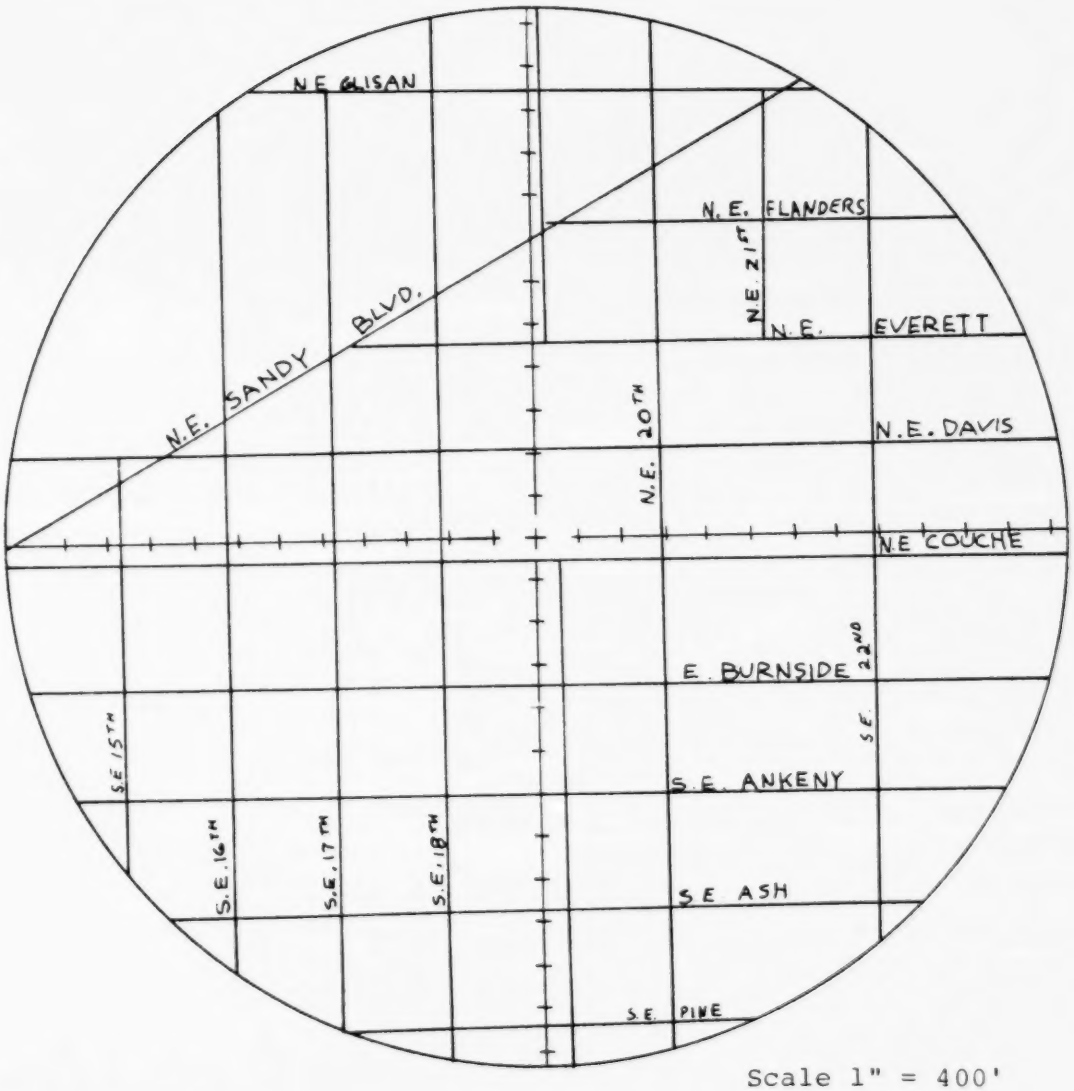
Source	Distance	Description
Northeast Davis	195 ft	800 ADT, clean, curbed
Northeast Couch	60 ft	800 ADT, clean, curbed

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	48	60
1975	45	61
1974	53	58
1973	52	76



One mile radius around 1845 Northeast Couch site.



Scale 1" = 400'

One-quarter mile radius around 1845 Northeast Couch site.

Viewed to the northeast.

Viewed to the northwest.

Sampler at 1845 Northeast Couch.

POINT SOURCE SUMMARY

Site: 1845 Northeast Couch

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction, °
9	86	.72	45
8	142	1.15	290
10	150	1.5	300
11	28	3.6	295
12	127	4.8	55
15	175	4.9	335

AREA SOURCE SUMMARY

Site: 1845 Northeast Couch

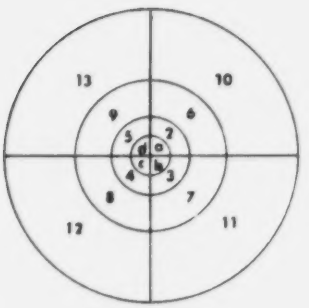
Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel		0.3	0.3	0.3	0.3	0.3	1.0	1.0	1.0	1.0	5.5
Comm/Ind fuel		0.8	0.7	0.7	0.7	0.7	2.5	2.5	2.5	2.5	13.6
Incinerators		0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.3	1.7
Rail/Air		0.1	0.1	0.1	0.1	0.1	0.4	0.4	0.4	0.4	2.1
Auto exhaust	192.9×10^6 VMT	4.2	8.2	1.4	3.4	10.2	22.1	5.3	30.2	42.6	127.6
AREA SOURCE INDUS PROCESSES:											
Ind processes		0.5	0.4	0.4	0.4	0.4	1.4	1.4	1.4	1.4	7.7
FUGITIVE DUST:											
Railroad yards	15 ac								1.2	0.3	1.5
Clean streets	192.9×10^6 VMT	18.2	35.4	6.2	14.6	44.2	95.9	22.9	130.8	184.6	552.8
Comm streets											
Unpaved roads											
Cleared areas											
Construction	2.9 ac						0.3		0.6	0.6	1.5
Agriculture											
Storage areas	0.4 ac										
Unpaved pkg lots	0.2 ac					0.1		0.1			0.2

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	5.5	28.0	117.0	150.5
IND PROCESSES	0.5	1.6	5.6	7.7
FUGITIVE DUST	18.2	100.5	437.3	556.0
Total	24.2	130.1	559.9	714.2

DESCRIPTION OF SITE

SAROAD code - 38 1460 011

Location - 1830 Southeast Schiller,
Portland, Oregon



Monitor height - 23ft, on roof of
truck terminal

Land use, by sector -

1a light industry	6 light industry
1b light industry	7 light residential
1c dense residential	8 undeveloped
1d light industry	9 dense residential
2 light industry	10 dense residential
3 light industry	11 dense residential
4 dense residential	12 dense residential
5 dense residential	13 central commercial

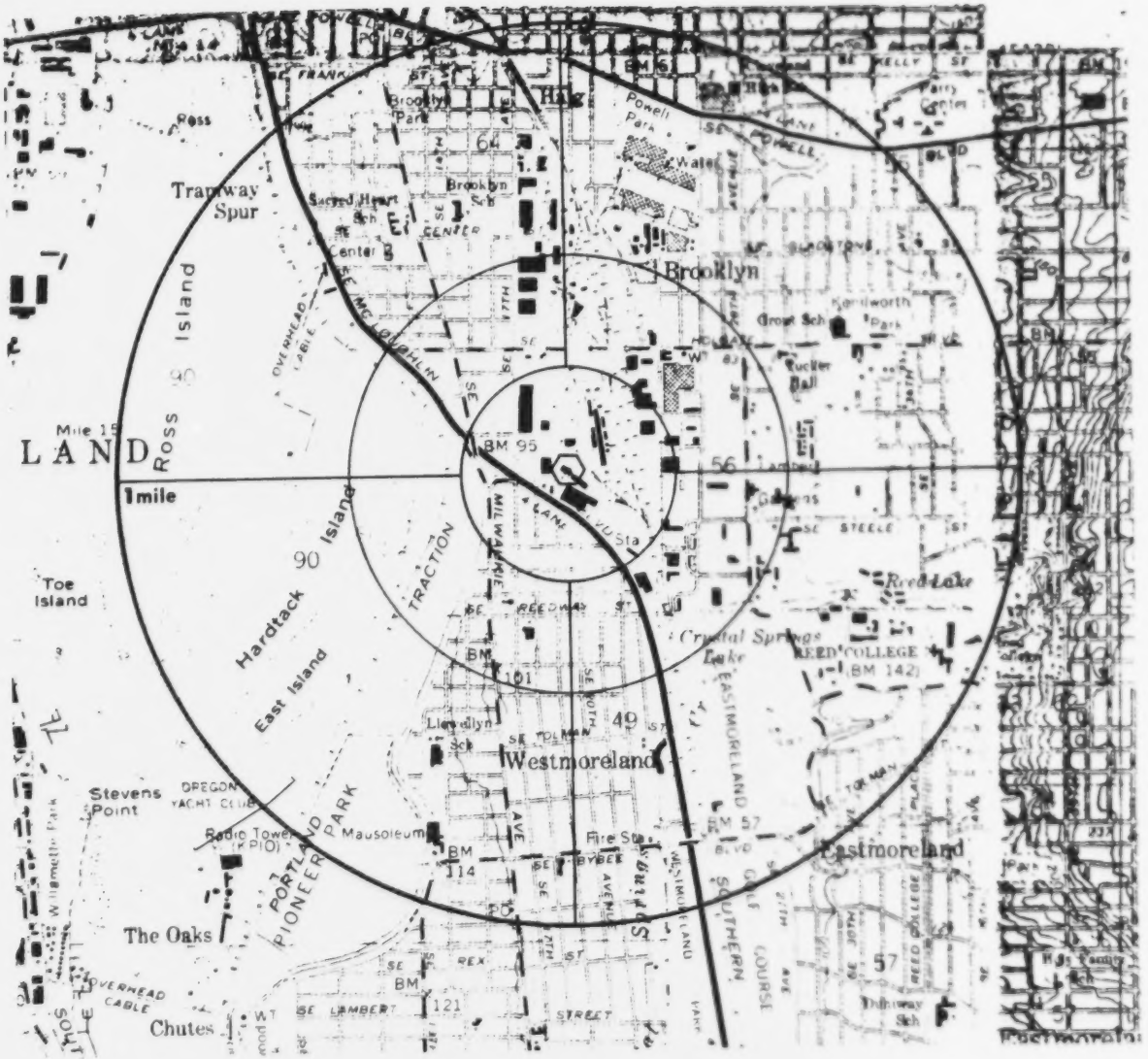
Topography-no special terrain

Localized sources, within 200 ft of monitor -

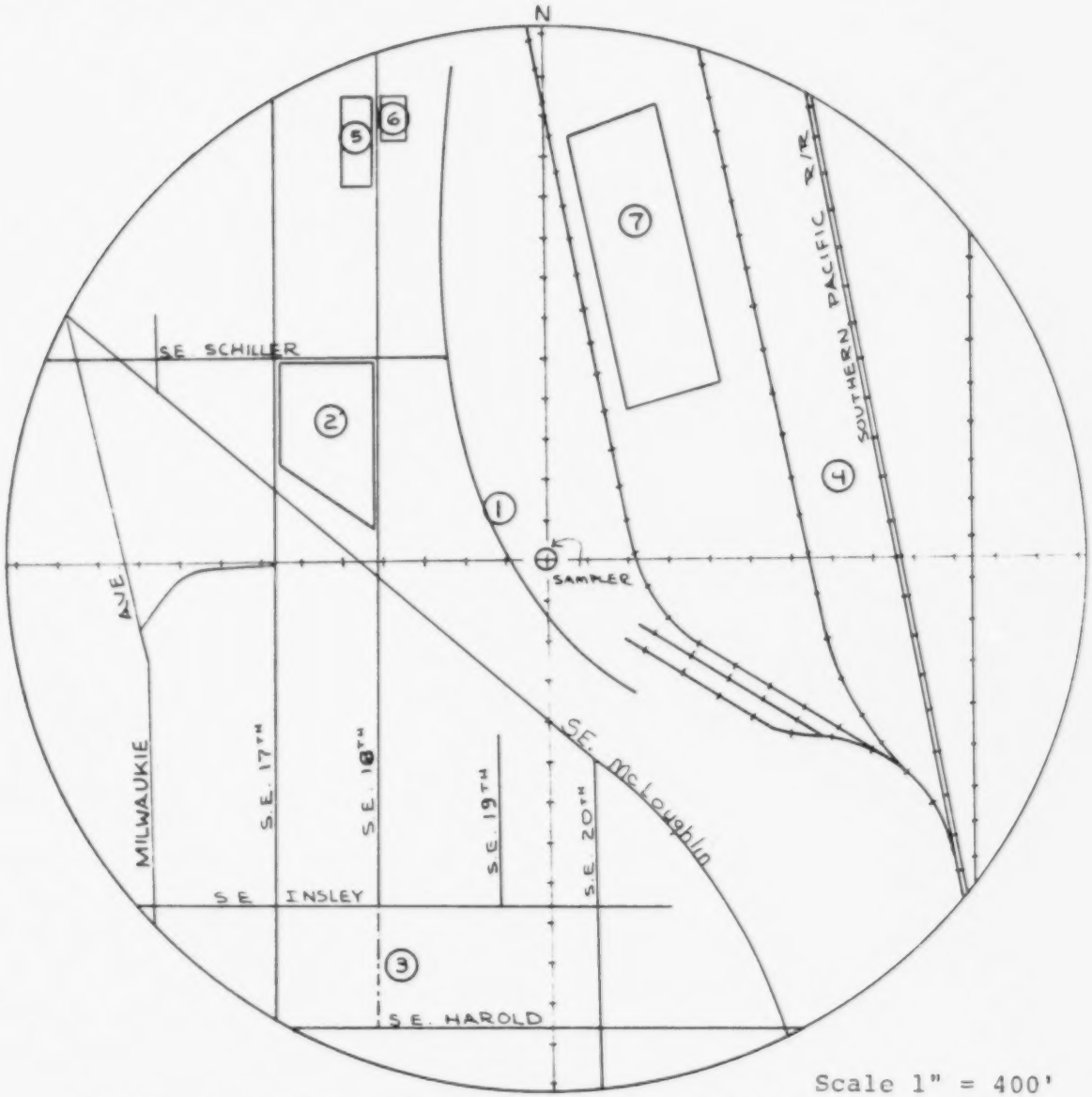
Source	Distance	Description
Truck dock	25 ft	gasoline, diesel, exhaust
Southeast Schiller	50 ft	200 ADT, dirty, uncurbed

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	78	67
1975	60	59
1974	70	58
1973	70	77



One mile radius around 1830 Southeast Schiller site.



Scale 1" = 400'

1. Pacific Motor Trucking, gasoline and disel emis., 200 trucks
2. Unpaved lot, 2.2 acres, 40 trucks, 80 cars
3. Unpaved alley, 200 ft, 10 cars
4. Rail yards, 34 acres
5. Unpaved storage area, 0.4 acre
6. Unpaved lot, 0.3 acre, 40 cars
7. Unpaved truck storage, 4.1 acres

One-quarter mile radius around 1830 Southeast Schiller site.

Viewed to the north-northwest.

Viewed to the southeast.

Sampler at 1830 Southeast Schiller.

POINT SOURCE SUMMARY

Site: 1830 Southeast Schiller

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction, °
6	69	2.7	180
8	142	3.1	340
9	86	3.1	10
10	150	3.6	340
7	184	4.2	100
3	238	4.8	190

AREA SOURCE SUMMARY

Site: 1830 Southeast Schiller

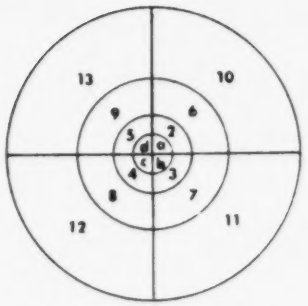
Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel		0.2	0.2	0.2	0.2	0.2	0.6	0.4	0.2	0.4	2.6
Comm/Ind fuel		0.6	0.6	0.6	0.6	0.1	0.1	0.3	0.2	0.2	3.3
Incinerators		0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.1	1.8
Rail/Air		0.5	0.3				0.2		0.3	3.1	4.4
Auto exhaust	76.1×10^6 VMT	5.9	2.7	3.2	0.9	5.4	9.3	10.0	3.2	9.7	50.3
AREA SOURCE INDUS PROCESSES:											
Ind processes		6.8	6.8	6.8	6.8	6.8	0.5	0.2	0.2	18.2	53.1
FUGITIVE DUST:											
Railroad yards	67.8 ac	3.4	1.3	0.2	0.2	0.2	0.6	0.1	0.2	0.6	6.8
Clean streets	71.9×10^6 VMT	21.2	9.7	11.7	4.0	23.2	36.9	43.5	14.0	41.8	206.0
Comm streets	4.2×10^6 VMT	18.6	8.6	10.0			14.5				51.7
Unpaved roads	1900 ft	0.1					0.6				0.7
Cleared areas											
Construction	7.6 ac		0.6			1.1	1.0			0.4	3.1
Agriculture											
Storage areas	9.3 ac	0.3		0.3			0.3				0.9
Unpaved pkg lots	3.9 ac	2.0	0.2							0.3	2.5

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	7.4	16.0	39.0	62.4
IND PROCESSES	6.8	27.2	19.1	53.1
FUGITIVE DUST	45.6	71.3	154.8	271.7
Total	59.8	114.5	212.9	387.2

DESCRIPTION OF SITE

SAROAD code - 38 1460 010

Location - 10625 Southwest 35th Street,
Portland, Oregon



Monitor height - 50 ft, on roof of
Jackson High School

Land use, by sector -

1a light residential	6 light residential
1b light residential	7 light residential
1c light residential	8 light residential
1d light residential	9 light residential
2 light residential	10 light residential
3 light residential	11 light residential
4 light residential	12 dense residential
5 suburban commercial	13 dense residential

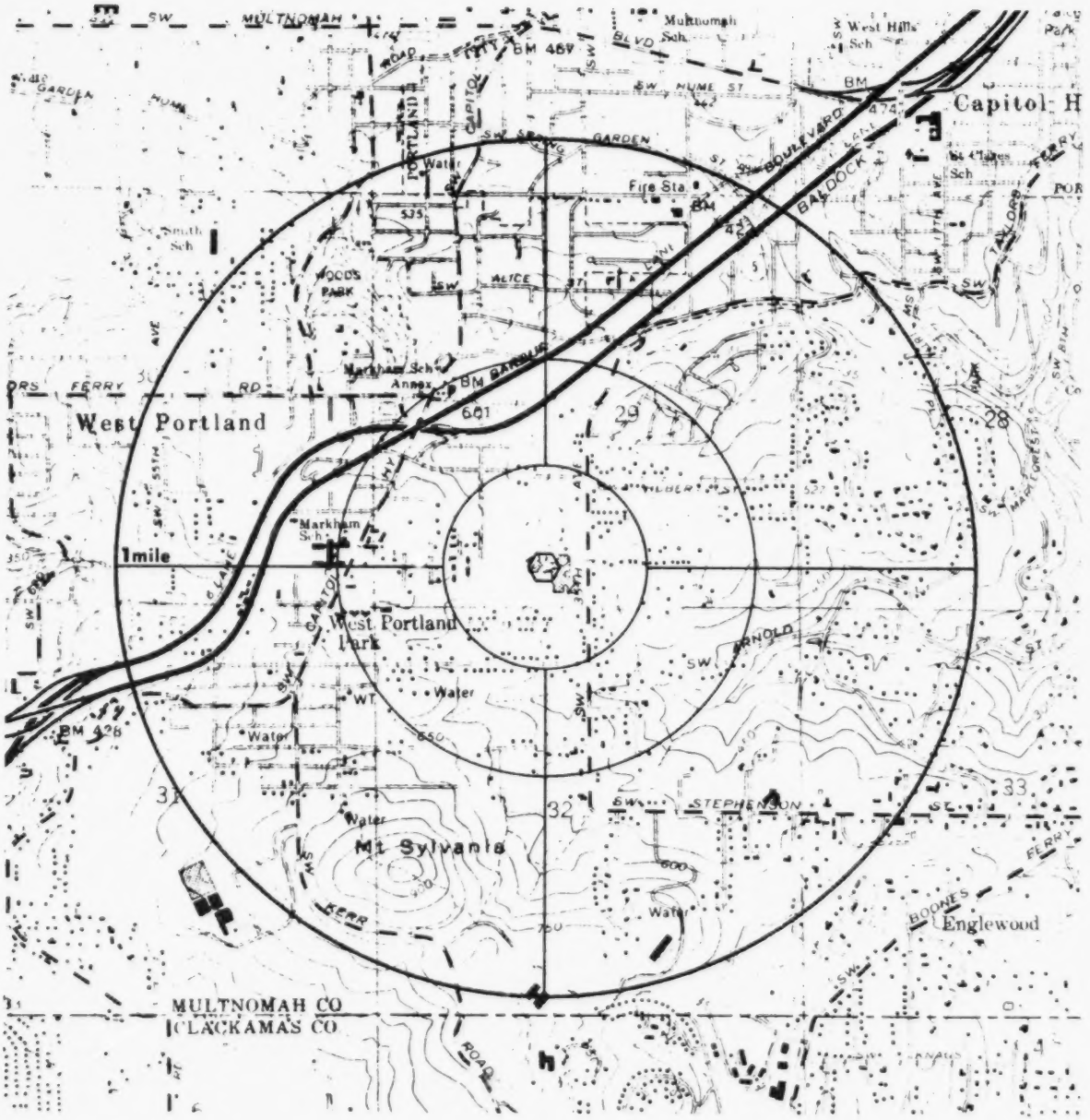
Topography-no special terrain

Localized sources, within 200 ft of monitor -

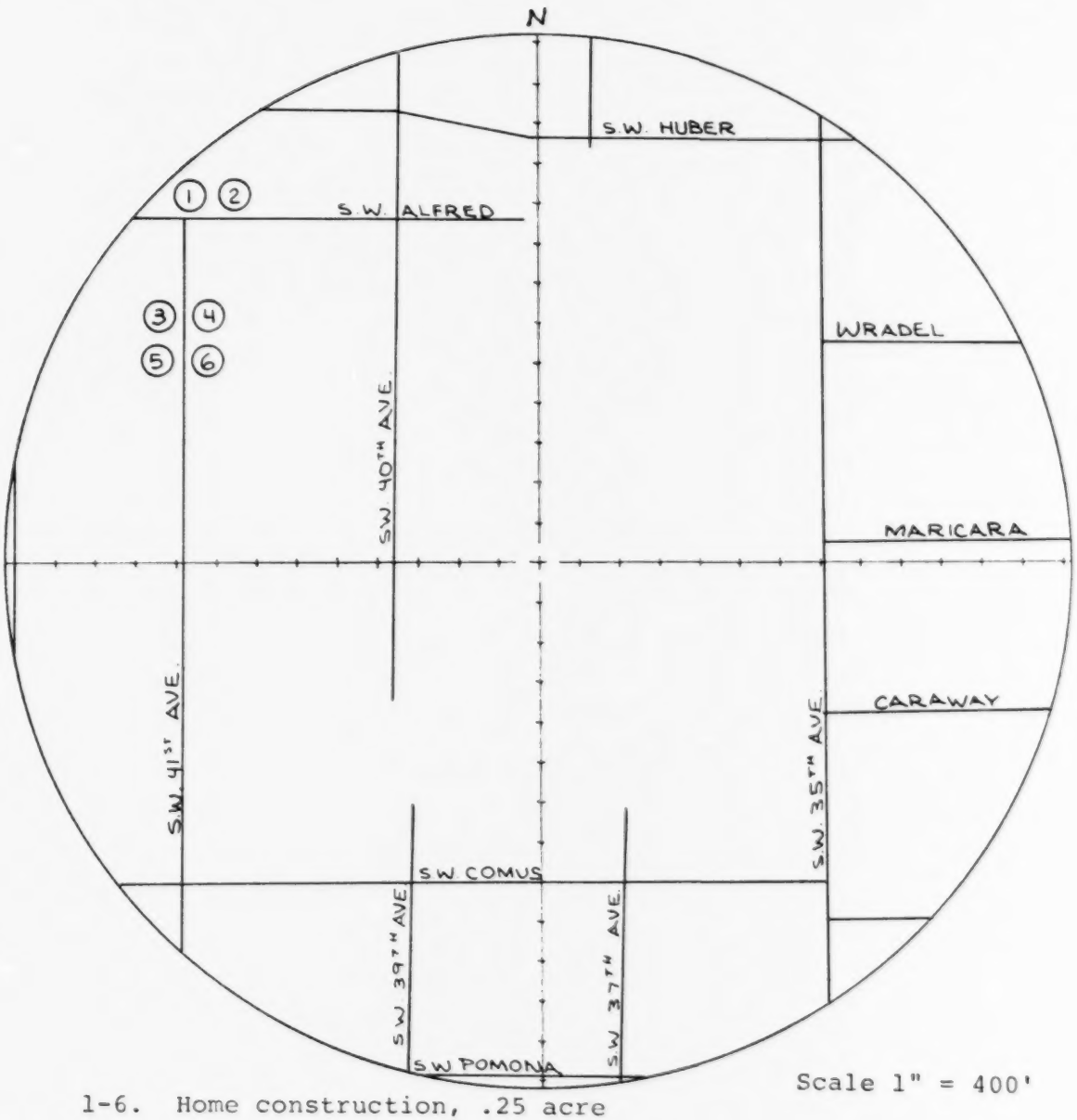
Source	Distance	Description
None		

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	30	54
1975	24	54
1974	28	56
1973	29	66

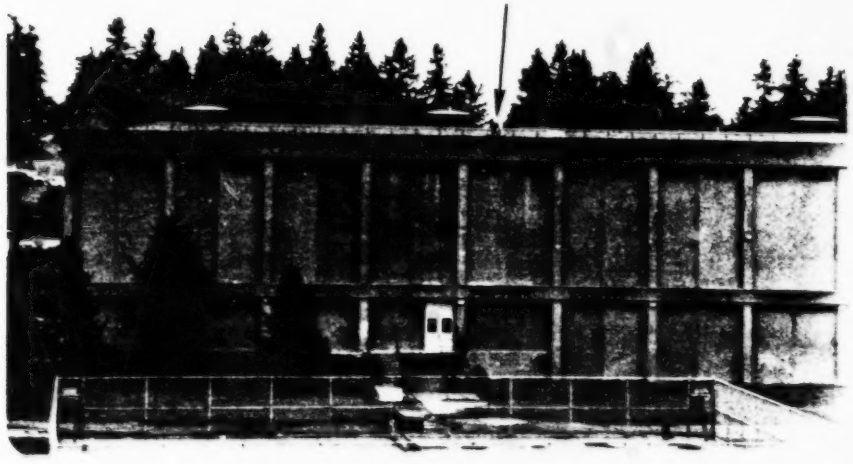


One mile radius around 10625 Southwest 35th Street site.

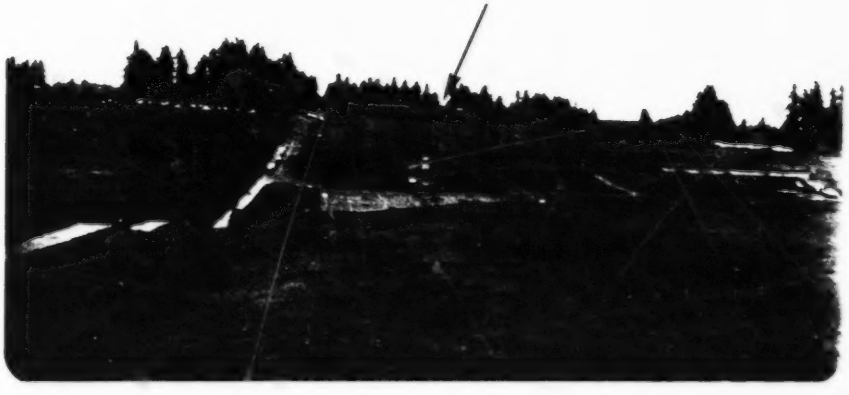


1-6. Home construction, .25 acre

One-quarter mile radius around 10625 Southwest 35th Street site.



Viewed to the east.



Viewed to the east.

Sampler at 10625 Southwest 35th Street.

POINT SOURCE SUMMARY

Site: 10625 Southwest 35th Street

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction,°
5	65	2.7	235
6	69	3.4	95
3	238	3.5	130
4	29	3.9	255

AREA SOURCE SUMMARY

Site: 10625 Southwest 35th Street

Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel		0.1	0.1	0.1	0.1	0.1	0.4	0.4	0.4	0.4	2.1
Comm/Ind fuel		0.1	0.1	0.1	0.1	0.1	0.4	0.4	0.4	0.4	2.1
Incinerators											
Rail/Air											
Auto exhaust	68.2×10^6 VMT	0.5	3.0	0.3	0.7	10.2	10.6	0.9	9.4	9.4	45.0
AREA SOURCE INDUS PROCESSES:											
Ind processes						1.0					1.0
FUGITIVE DUST:											
Railroad yards											
Clean streets	68.2×10^6 VMT	2.3	13.0	1.4	3.0	44.4	45.7	4.0	40.9	40.7	195.4
Comm streets											
Unpaved roads	0.3 mi									2.5	2.5
Cleared areas											
Construction	5.0 ac	0.6					0.4		0.2	0.8	2.0
Agriculture											
Storage areas											
Unpaved pkg lots											

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	0.7	15.0	33.5	49.2
IND PROCESSES		1.0		1.0
FUGITIVE DUST	2.9	61.8	135.2	199.9
Total	3.6	77.8	168.7	250.1

DESCRIPTION OF SITE

SAROAD code - 38 1380 002

Location - Eighth and Main,
Oregon City, Oregon

Monitor height - 62 ft, on roof of
courthouse

Land use, by sector -

1a central commercial
1b dense residential
1c central commercial
1d light residential

2 light industry
3 dense residential
4 general industry
5 light residential
6 light industry
7 light residential
8 general industry
9 light residential
10 light residential
11 light residential
12 light residential
13 light residential

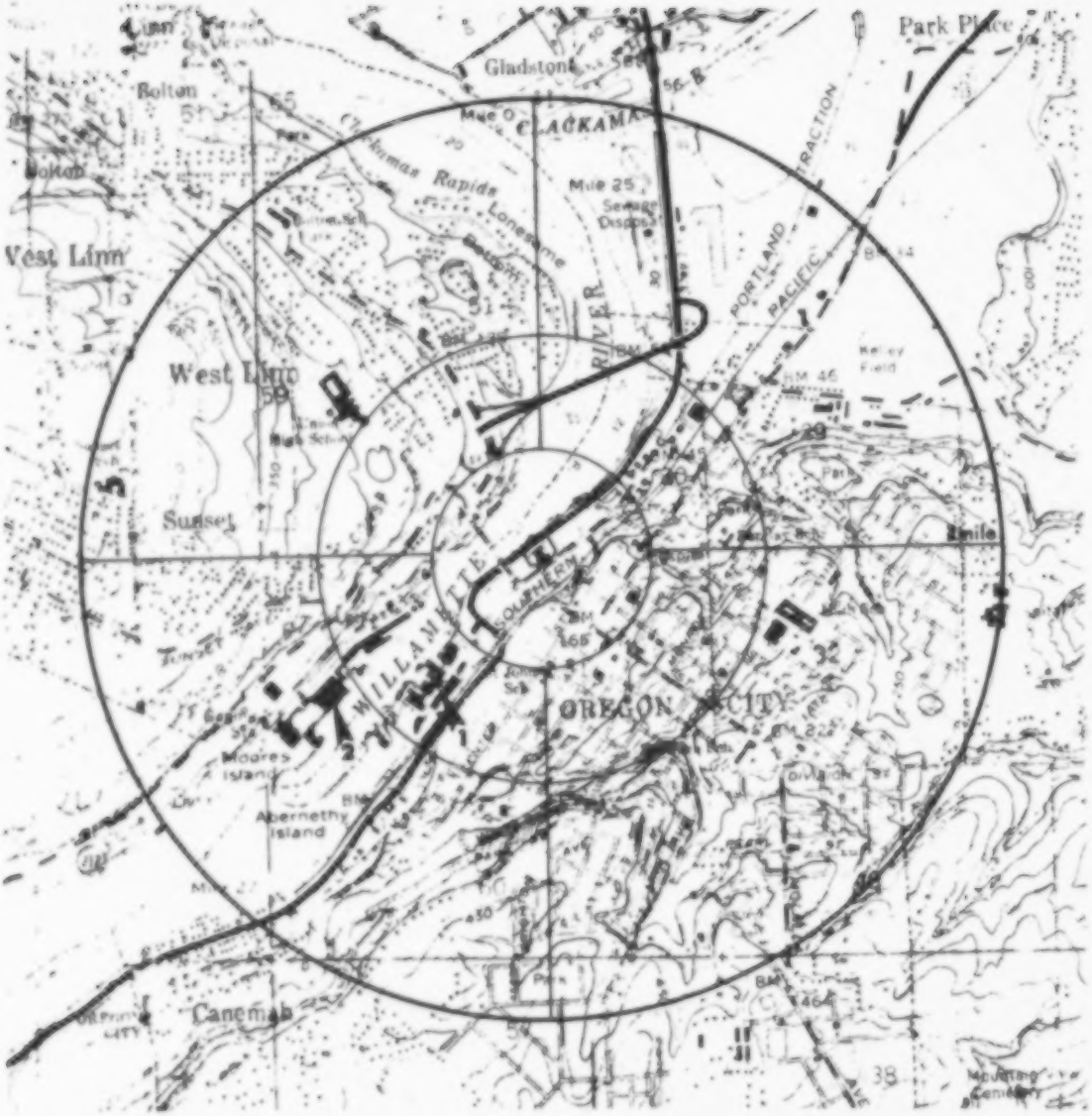
Topography-River Valley

Localized sources, within 200 ft of monitor -

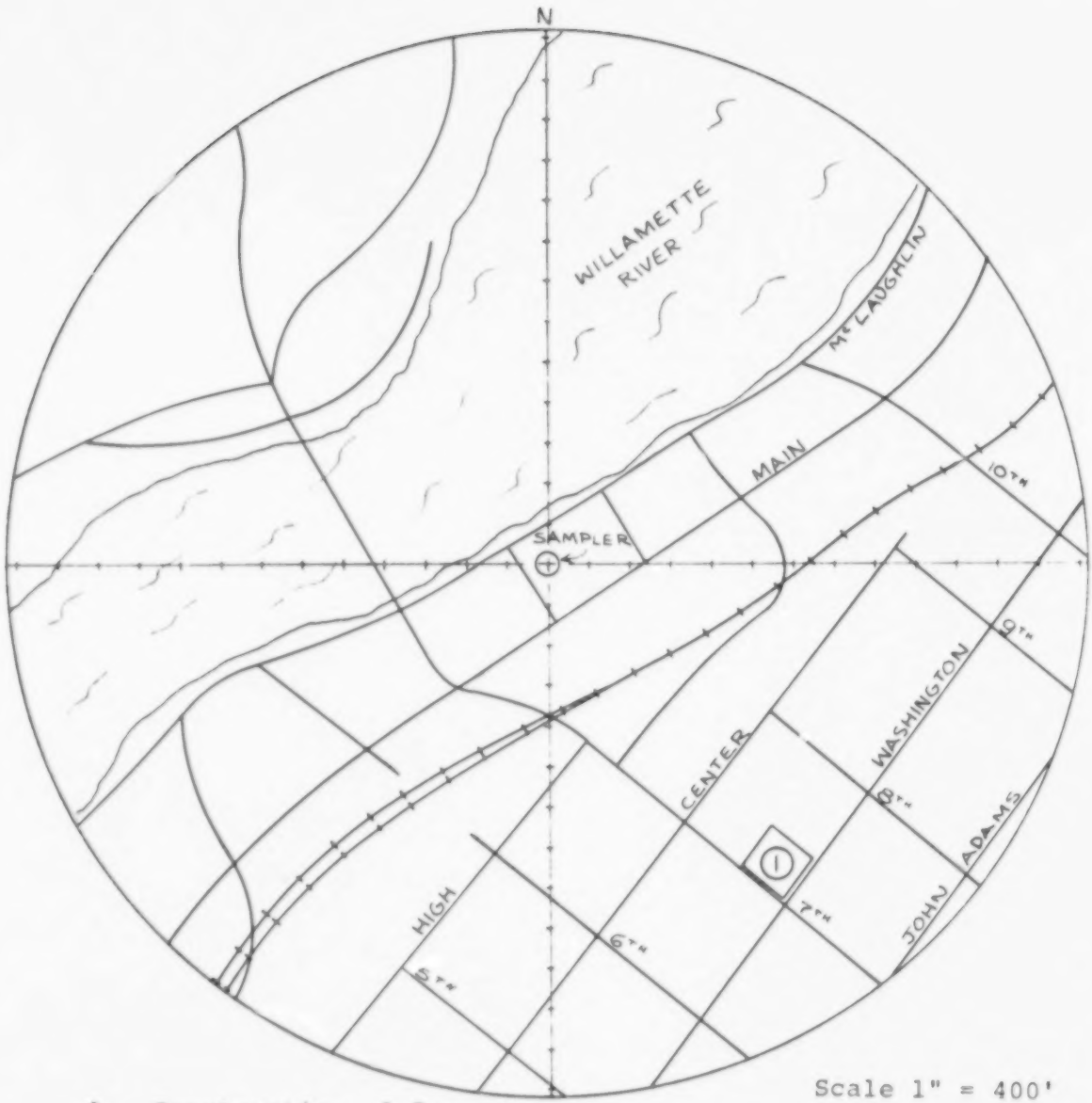
Source	Distance	Description
Eighth Street	60 ft	800 ADT, clean, curbed
McLaughlin	84 ft	14,300 ADT, clean, curbed
Main	130 ft	9,500 ADT, clean, curbed

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	47	61
1975	38	58
1974	47	53
1973	44	61



One mile radius around Eighth and Main site.



Scale 1" = 400'

1. Construction, 0.5 acre

One-quarter mile radius around Eighth and Main site.

Viewed to the north.

Viewed to the west-northwest.

Sampler at Eighth and Main.

POINT SOURCE SUMMARY

Site: Eighth and Main

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction, °
1	196	.38	215
2	287	.55	235
3	238	4.7	320

AREA SOURCE SUMMARY

Site: Eighth and Main

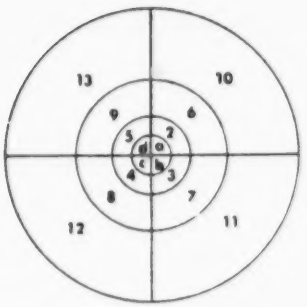
Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel		0.1					0.1	0.1	0.1	0.1	0.5
Comm/Ind fuel		0.2	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.5	2.6
Incinerators		0.2	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.5	2.6
Rail/Air											
Auto exhaust	51.6×10^6 VMT	6.1	4.0	1.4	1.3	3.2	7.3	4.0	5.2	1.5	34.0
AREA SOURCE INDUS PROCESSES:											
Ind processes										10.1	10.1
FUGITIVE DUST:											
Railroad yards											
Clean streets	51.6×10^6 VMT	26.6	17.4	6.2	5.5	13.7	31.7	17.6	22.7	6.6	148.0
Comm streets											
Unpaved roads											
Cleared areas	12 ac						0.7				0.7
Construction											
Agriculture											
Storage areas	15 ac aggregate						3.3				3.3
Unpaved pkg lots	2.1 ac						2.6				2.6

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	6.6	10.7	22.4	39.7
IND PROCESSES			10.1	10.1
FUGITIVE DUST	26.6	42.8	85.2	154.6
Total	33.2	53.5	117.7	204.4

DESCRIPTION OF SITE

SAROAD code - 38 1460 002

Location - 718 West Burnside,
Portland, Oregon



Monitor height - 110 ft, on roof of
seven story building

Land use, by sector -

1a central commercial
1b central commercial
1c central commercial
1d central commercial

2 light industry
3 light industry
4 central commercial
5 central commercial

6 light industry
7 light industry
8 light industry
9 light industry

10 dense residential
11 dense residential
12 dense residential
13 light industry

Topography-elevated receptor

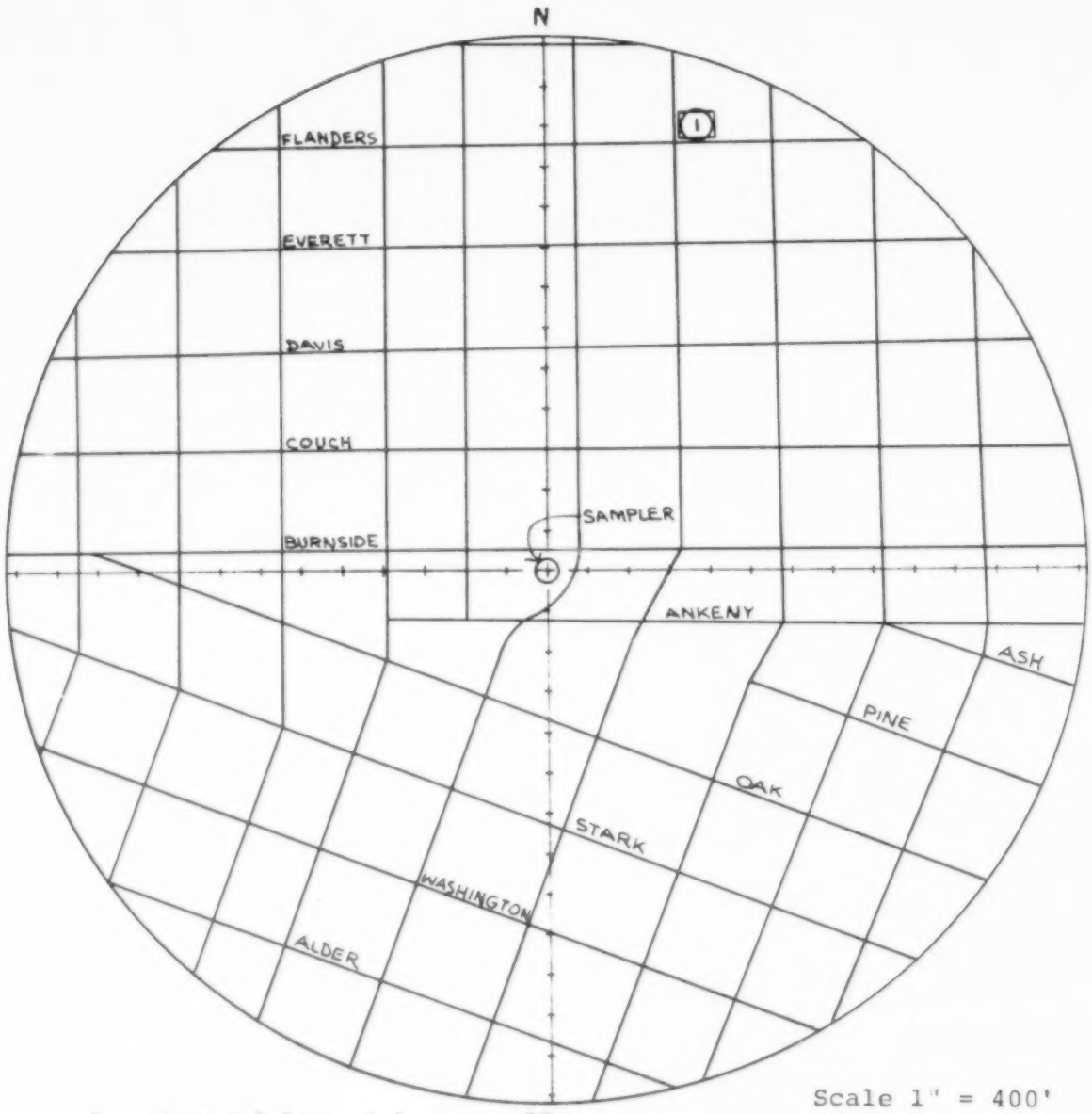
Localized sources, within 200 ft of monitor -

Source	Distance	Description
Broadway	80 ft	10,100 ADT, clean, curbed
Burnside	40 ft	28,100 ADT, clean, curbed
Ankeny	120 ft	800 ADT, clean, curbed
Northwest Seventh Street	110 ft	500 ADT, clean, curbed

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	64	78
1975	51	58
1974	71	49
1973	76	53

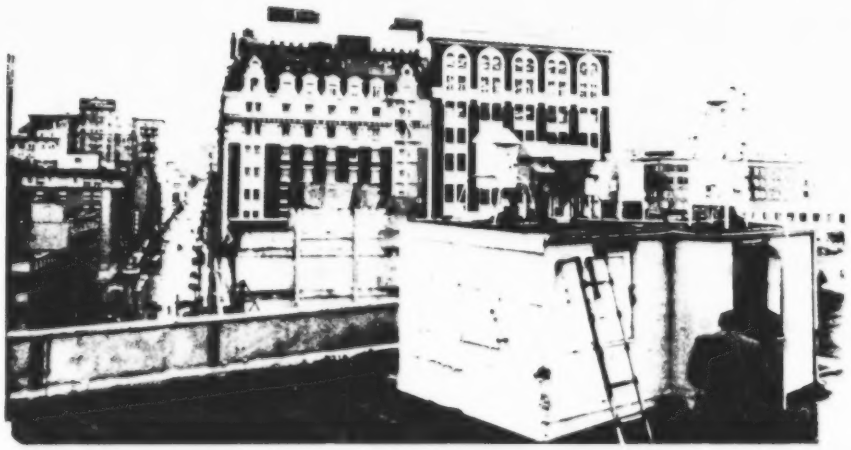
One mile radius around 718 West Burnside site.



Scale 1" = 400'

1. Unpaved lot, 0.1 acre, 25 cars

One-quarter mile radius around 718 West Burnside site.



Viewed to the southwest.

Viewed to the west.

Sampler at 718 West Burnside.

POINT SOURCE SUMMARY

Site: 718 West Burnside

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction, °
8	142	.60	45
10	150	.78	15
9	86	2.1	75
11	28	2.4	315
13	31	4.4	310
15	175	4.5	355
14	61	4.6	315

AREA SOURCE SUMMARY

Site: 718 West Burnside

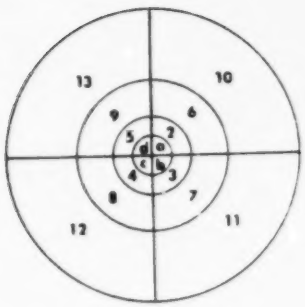
Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel		0.7	0.7	0.7	0.2	0.2	2.2	2.2	0.2	0.4	7.5
Comm/Ind fuel		0.4			1.1	1.2	0.6	0.7	4.0	4.1	12.1
Incinerators											
Rail/Air/Ships		0.4	0.4	0.4	0.1	0.1	1.3	2.3		1.1	6.1
Auto exhaust	271.4×10^6 VMT	11.0	5.3	10.0	12.4	6.9	41.6	42.5	33.2	16.5	179.4
AREA SOURCE INDUS PROCESSES:											
Ind processes		0.4	0.2	0.2	0.6	0.6	3.0	7.3	25.4	26.1	63.8
FUGITIVE DUST:											
Railroad yards	80 ac		1.0			0.7	1.0	1.5		3.8	8.0
Clean streets	267.1×10^6 VMT	47.9	20.5	43.6	53.9	26.9	180.1	184.3	144.0	64.3	765.5
Comm streets	4.3×10^6 VMT		10.0			12.7				30.9	53.6
Unpaved roads											
Cleared areas											
Construction	8.9 ac	0.4		0.4	0.4			0.4	1.8		3.4
Agriculture											
Storage areas											
Unpaved pkg lots	0.1 ac									0.1	0.1

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	12.5	39.7	152.9	205.1
IND PROCESSES	0.4	1.6	61.8	63.8
FUGITIVE DUST	48.3	170.1	612.2	830.6
Total	61.2	211.4	826.9	1099.5

DESCRIPTION OF SITE

SAROAD code - 38 1460 015

Location - 55 Southwest Ash,
Portland, Oregon



Monitor height - 45 ft, on roof of
fire station

Land use, by sector -

1a undeveloped
1b undeveloped
1c central commercial
1d central commercial

2 light industry
3 light industry
4 central commercial
5 light industry
6 light industry
7 light industry
8 central commercial
9 light industry

10 dense residential
11 dense residential
12 dense residential
13 light industry

Topography-no special terrain

Localized sources, within 200 ft of monitor -

Source	Distance	Description
Front Street	65 ft	22,750 ADT, clean, curbed
Southwest Ash Street	42 ft	800 ADT, clean, curbed
Construction area	125 ft	1.0 acre
Southwest First Avenue	180 ft	1700 ADT, clean, curbed

Air quality data -

Year	Annual geometric mean, ug/m^3	No. of samples
1976	76	76
1975	58	56
1974	68	60
1973	74	76

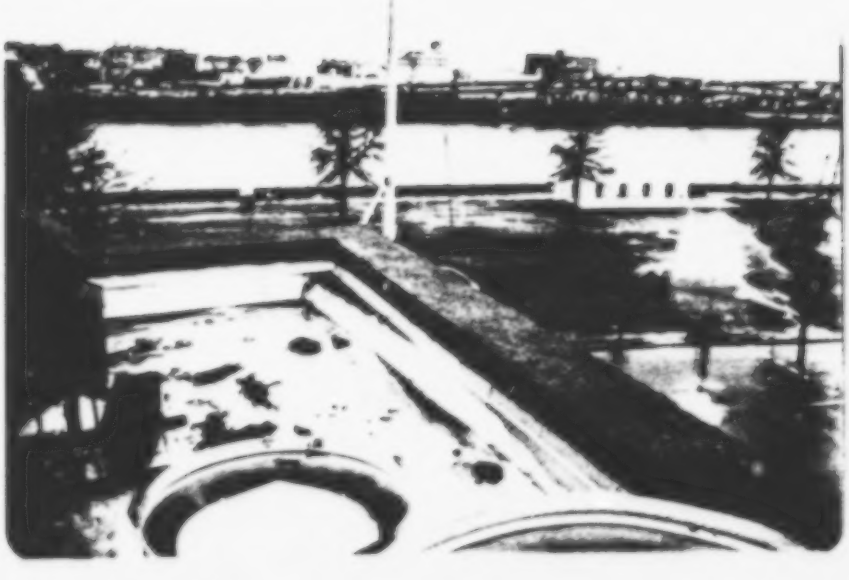
One mile radius around 55 Southwest Ash site.

Scale 1" = 400'

1. Construction, 1.0 acre

One-quarter mile radius around 55 Southwest Ash site.

Viewed to the south.



Viewed to the east.

Sampler at 55 Southwest Ash.

POINT SOURCE SUMMARY

Site: 55 Southwest Ash

Plant number	Emission level, t/yr	Distance from site, mi	Compass direction, °
8	142	.52	10
10	150	.83	350
9	86	1.8	70
11	28	2.7	310
15	175	4.7	350
13	31	4.7	310
14	61	4.9	315

AREA SOURCE SUMMARY

Site: 55 Southwest Ash

Source category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel							0.3	0.4	0.4	0.2	1.3
Comm/Ind fuel		1.0	0.8	0.8	0.8	0.8	2.9	2.1	3.1	4.1	16.4
Incinerators							0.1	0.1			0.2
Rail/Air /Ships			0.5	0.4		0.3	0.2	1.7	0.8	3.4	7.3
Auto exhaust	286.7×10^6 VMT	14.4	21.2	14.5	10.6	4.5	40.1	28.4	36.9	19.0	189.6
AREA SOURCE INDUS PROCESSES:											
Ind processes						1.7	0.7	6.4	6.3	27.7	42.8
FUGITIVE DUST:											
Railroad yards	78 ac		0.8	0.6		0.5	0.1	0.9		4.9	7.8
Clean streets	282.4×10^6 VMT	62.4	91.7	62.7	46.0	19.4	174.0	123.2	159.9	69.9	809.2
Comm streets	4.3×10^6 VMT									53.6	53.6
Unpaved roads											
Cleared areas											
Construction	10.3 ac				0.4		0.5	0.5	0.8	1.8	4.0
Agriculture											
Storage areas	0.4 ac						0.1				0.1
Unpaved pkg lots	0.1 ac									0.1	0.1

Recap	Emissions by sector, t/yr			
	1	2-5	6-9	Total
COMBUSTION	15.4	55.2	144.2	214.8
IND PROCESSES		1.7	41.1	42.8
FUGITIVE DUST	62.4	222.1	590.3	874.8
Total	77.8	279.0	775.6	1132.4

APPENDIX A

LISTING OF POINT SOURCES IN THE PORTLAND INTERSTATE AQCR

Table A-1. LISTING OF POINT SOURCES IN THE PORTLAND INTERSTATE AQCR

No.	Name	State	County	AQCR	EI#[a]	Emission, tpy	Stack ht,ft	UTM Coord x	UTM Coord y	SIC
1.	Publishers Paper, Oregon City	38	0260	193	31850	50	125	530.7	5022.1	2621
						71	110			
						75	40			
2.	Crown Zellerbach	38	0260	193	32145	259	150	530.0	5022.2	2621
						28	138			
3.	Oregon Portland Cement	38	0260	193	31840	141	250	526.7	5029.2	3241
						75	87			
						22	30			
4.	L. H. Cobb Crushed Rock	38	1860	193	341925	29	12	516.4	5031.1	3295
5.	Western Foundry	38	1860	193	341879	57	51	518.7	5030.3	3321
						8	25			
6.	Milwaukie Plywood	38	0260	193	1874	39	35	528.9	5032.4	2436
						30	130			
7.	Publishers Paper, Portland	38	1240	193	262075	23	30	534.4	5035.6	2421
						44	40			
						17	50			
						100	80			
8.	Dreyfus Corporation	38	1240	193	262000	45	30	526.0	5041.6	2041
						56	60			
						41	120			
9.	Barker Manufacturing	38	1240	193	261878	32	210	528.4	5041.8	2511
						54	60			
10.	Bunge Corporation	38	1240	193	262003	75	30	525.4	5042.2	5153
						75	40			
11.	Hercules, Incorporated	38	1240	193	261814	28	100	522.7	5043.6	2899
12.	Owens Illinois	38	1240	193	261876	28	36	534.2	5045.4	3231
						82	70			
						17	85			
13.	Shell Oil Company	38	1240	193	262028	22	85	520.1	5045.7	5171
						9	31			

[a] 1975 Emissions inventory data base for the Portland AQMA.

Table A-1. (continued) LISTING OF POINT SOURCES IN THE PORTLAND INTERSTATE AQCR

No.	Name	State	County	AQCR	EI#[a]	Emission, tpy	Stack ht, ft	UTM Coord x	UTM Coord y	SIC
14.	Pennwalt Corporation	38	1240	193	262424	26	35	520.0	5046.1	2812
						20	50			
						15	60			
15.	Nicolai Door Manufacturing	38	1240	193	262074	12	45	524.7	5047.8	2431
						78	58			
						85	70			
16.	Pacific Carbide	38	1240	193	262015	55	25	522.6	5048.9	2819
						13	35			
						8	50			
						107	80			
17.	Linnton Plywood	38	1240	193	262073	52	30	517.0	5049.1	2436
18.	Terminal Four	38	1240	193	262909	33	30	517.5	5049.8	4463
19.	Cargill Grain	38	1240	193	262009	97	25	517.4	5050.1	4221
						44	50			
						110	100			
						255	129			
						84	212			
						66	245			
20.	Union Carbide	38	1240	193	0	17	50	518.3	5050.5	2819
						24	75			
21.	Oregon Steel Mills	38	1240	193	261865	20	59	516.9	5052.0	3312
						27	75			
22.	Boise Cascade	49	0360	193	360013	45	50	525.0	5052.0	2621
						26	160			
23.	Midrex	38	1240	193	261888	53	25	516.8	5052.3	3312
						37	94			
						40	117			
24.	United Grain	49	0360	193	360002	43	15	524.2	5052.8	5153
25.	Fort Vancouver Plywood	49	0360	193	360008	16	35	524.7	5052.9	2436
						11	50			
						55	90			

[a] 1975 Emissions inventory data base for the Portland AQMA.

Table A-1. (continued) LISTING OF POINT SOURCES IN THE PORTLAND INTERSTATE AQCR

No.	Name	State	County	AQCR	EI#[a]	Emission, tpy	Stack ht, ft	UTM Coord x	UTM Coord y	SIC
26.	Carborundum	49	0360	193	360009	26	25	523.5	5053.3	3291
						12	50			
						787	70			
						23	130			
27.	Alcoa Aluminum	49	0360	193	360011	687	55	521.0	5055.0	3334
						20	250			

[a] 1975 Emissions inventory data base for the Portland AQMA.

APPENDIX B

DEVELOPMENT OF EMISSION FACTORS

RAILROAD YARDS

Most of the emissions in train yards appear to be from wind erosion rather than from train movement. Therefore, an adaptation of the U.S. Department of Agriculture's wind erosion equation was used as the basis for deriving emission factors for railroad yards. The modified equation estimates annual suspended particulate emissions due to wind erosion from exposed soil surfaces:[10]

$$E = a\ I\ K\ C\ L'\ V' \qquad \text{(eq.1)}$$

where E = emission factor, ton/acre/yr

a = portion of total wind erosion losses that would be measured as suspended particulate, estimated to be 0.025

I = soil erodibility, ton/acre/yr

K = surface roughness factor

C = climatic factor

L' = unsheltered field width factor

V' = vegetative cover factor

In this equation, K, C, L', and V' are all dimensionless. An average erodiblity (I) of 86 ton/acre/yr was assumed to be applicable for the soil in the railroad yards. The area around railroad yards generally has a fairly smooth surface which is equivalent to a K value of 1.0. The climatic factor for the Portland area is 0.07. An average width of 1000 ft was assumed for railroad yards, since this is not a critical variable in the equation. The L' value equivalent to L = 1000 ft was determined from a nomograph in which soil type is also a variable--0.85. There is no vegetation in rail yards so V = 0 and V' = 1.0. Also, these areas are generally treated with oil or chemicals to reduce

dust and weed problems. Therefore, the emissions have been estimated with the above values and the following assumptions:

- no vegetation
- sandy soil (I = 86)
- half the area is stabilized, with an emission rate of 20 percent of the unstabilized area
- train traffic increases the wind erosion emissions by 20 percent

Therefore, the resulting emission factor is:

$$E = (0.025)(86)(1.0)(0.07)(0.85)(1.0)\left(\frac{1 + 0.2}{2}\right)(1.2)$$

$$= 0.1 \text{ ton/acre/yr}$$

REENTRAINED DUST FROM PAVED STREETS

The most recent emission factors for estimating emissions from paved roads were obtained from a draft of AP-42. The recommended emission factors are 5.0 gm/VMT for clean streets and 20 gm/VMT for commercial streets. These factors include an exhaust emission factor and are not corrected for days with rain.

Based on national estimates for the percentage of heavy duty gasoline and diesel trucks, an exhaust emission factor of 0.6 gm/VMT was calculated from published emission factor data.[11] This factor was subtracted from the paved road emission factors and the resulting values were corrected for rainfall.

Historical rainfall data for Portland indicate a mean of 152 days with at least 0.01 inch of rain.[12] Based on this information, the reentrained dust emission factors were

reduced by approximately 42 percent. The corrected emission factors are: 2.6 gm/VMT for clean streets and 11.3 gm/VMT for commercial streets.

UNPAVED ROADS

Many different groups have investigated emissions from unpaved roads. All the studies show emission rates usually in the range of one to 20 lb/VMT, and show that the rate is highly dependent on vehicle speed. After reviewing these studies, EPA selected the following emission factor for publication in AP-42:[11]

$$E = (0.6)(0.81)(s)(S/30)\left(\frac{365 - w}{365}\right) \quad \text{(eq.2)}$$

where E = emission factor, lb/VMT

0.6 = fraction of total particulate less than 30 u diameter

s = percent silt of road surface material

S = average vehicle speed, mph

w = mean annual number of days with 0.01 inch or more of precipitation

The percent silt on gravel road surfaces is about 12 percent based on data presented in the EPA publication, Development of Emission Factors for Fugitive Dust Sources.[10] For graded and drained road surfaces, no aggregate material is applied to the roadbed so it is composed of compacted native soil. The fine material originally on the surface is probably rapidly removed by turbulence from passing vehicles or by wind and water erosion forces. The remaining stable surface is composed of sand- and pebble-sized particles, with dust being generated primarily by the continuing mechanical breakdown of these particles as a result of traffic.

It is assumed that the percent of silt-sized particles on a seasoned dirt road surface is approximately the same as that for gravel, or 12 percent. The mean number of days with 0.01 inch or more of rainfall is 152. Assuming a vehicle speed of 20 mph, the average emission factor is 2.3 lb/VMT.

CLEARED OR EXPOSED AREAS

The modified wind erosion equation described earlier was used for estimating emissions from cleared or exposed areas. An average erodibility (I) of 47 ton/acre/yr was assumed for the soil types common to this area. The cleared areas are generally left with a fairly smooth surface, which is equivalent to a K value of 1.0. The climatic factor for the Portland area is 0.07. An average field width of 1000 ft was assumed for all the cleared areas, since this is not a critical variable in the equation. The L' value equivalent to L = 1000 ft was determined from a nomograph in which soil type is also a variable--0.68. There is no vegetation on cleared areas, so V = 0 and V' = 1.0.

Based on these input data, the average emission rate from cleared areas would be 0.06 ton/acre/yr.

CONSTRUCTION

The emission factor presented in AP-42 of 1.2 ton/acre/mo was corrected for the climatic conditions in Portland by use of the equation:[11]

$$E = \frac{1.2}{(PE/50)^2} \qquad \text{(eq.3)}$$

where PE = 153 for Portland

E = 0.13 ton/acre/mo

This value is appropriate for residential and commercial construction with excavation and regrading, and includes the effect on emission reduction of moderate watering of the site. Most construction projects are assumed to be fugitive dust sources for only three or four months a year.

AGRICULTURE

Total emissions from agriculture are calculated from the sum of tilling and wind erosion emissions. The factor for tilling from AP-42 is:[11]

$$E = (0.8)(1.4)s/(PE/50)^2 \qquad \text{(eq.4)}$$

where E = emission factor, lb/acre/run

0.8 = fraction of total particulate less than 30 u diameter

s = percent silt in surface soil

PE = precipitation-evaporation index

An average of three tilling operations per year is assumed, and a silt content of 65 percent. Therefore, total tilling losses are 23.3 lb/acre.

The modified wind erosion equation described earlier is recommended for determining the wind erosion component of agricultural emissions. All variables in the equation except C are dependent on either the soil type or crop grown on each field. The following average values were assumed for the Portland area:

$I = 47$

$K = 0.6$

$C = 0.07$

$L = 2000$ ft, $L' = 0.72$

$V = 100$ lb/acre, $V' = 0.85$

$E = 0.03$

Therefore, the combined agricultural losses are 0.04 ton/acre/yr.

AGGREGATE STORAGE AREAS

The emission factor for this source category was based on sampling performed in the Kansas City and Cincinnati areas. The emission factor (E) is:[10]

$$E = \frac{13.2}{(PE/100)^2} \qquad \text{(eq.5)}$$

where PE = 153 for Portland

E = emission factor, lb/acre/day

Assuming activity for six days a week, the annual emission factor is:

$E = 0.88$ ton/acre/yr

UNPAVED PARKING LOTS

If the average number of vehicles using a parking lot daily and the average distance of travel in the lot can be estimated, these data can be converted to VMT/yr and then multiplied by the emission factor for unpaved roads to determine unpaved parking lot emissions. With an average

speed of 10 mph in the parking lots, the emission factor is 1.1 lb/VMT. Usage of most lots for five or six days per week was assumed in calculating annual VMT.

UNPAVED STORAGE AREAS

No factor was found for this source category. By comparison with other source categories, it was estimated that annual emissions per acre from this source were greater than for a cleared area (0.06 ton/acre/yr) or railroad yards (0.1), but not nearly as high as aggregate storage (0.) or construction (0.5). A value of 0.15 ton/acre/yr was used for this minor source category.

GRAIN ELEVATORS

A value of 1.80 ton/silo/yr was developed from file data for a previous PEDCo study of particulate air quality in rural Kansas and Nebraska.[1] This same value was applied here for sources for which NEDS data were not available.

INCINERATORS

The emission factor for multiple chamber industrial/commercial incinerators from AP-42 was used in this inventory.[11] That value is 7.0 lb/ton of refuse incinerated.

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